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Minerals Yearbook

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Volume III

AREA REPORTS: INTERNATIONAL

Prepared by staff of the

BUREAU OF MINES

UNITED STATES DEPARTMENT OF THE INTERIOR • Manuel Lujan, Jr., Secretary

BUREAU OF MINES • T S Ary, Director

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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Foreword

This edition of the Minerals Yearbook discusses the performance of the worldwide minerals industry during 1987 and provides background information to assist in interpreting that performance. Content of the individual Yearbook volumes follows:

Volume I, Metals and Minerals, contains chapters on virtually all metallic and industrial mineral commodities important to the U.S. economy. In addition, it includes a statistical summary chapter, a chapter on mining and quarrying trends, and a chapter discussing the statistical surveying methods used by the Bureau of Mines.

Volume II, Area Reports: Domestic, contains chapters on the minerals 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 150 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 users. Therefore, constructive comments and suggestions by readers of the Yearbook will be welcomed.

T S Ary, *Director*

Acknowledgments

The Bureau of Mines, in preparing volume III, utilized extensively statistics and data on mineral production, consumption, and trade provided by various foreign government mineral and statistical agencies through various official publications. The cooperation and assistance of these organizations is gratefully acknowledged. Statistical and informational material was also obtained from reports 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 Division of International Minerals, Information and Analysis Directorate.

The regimes of some countries reviewed in this volume may not be 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.

Charles D. Hoyt, *Chief, Division of International Minerals*

Contents

Minerals in the World Economy

By Charles L. Kimbell[1] and William L. Zajac[2]

In overall aggregate, the world's mineral industry in 1987 experienced a more satisfactory year than in 1986, at least insofar as its performance could be assessed from traditional statistical indicators. Production, trade and consumption seemingly advanced in the case of the majority of commodities, and prices for a number of commodities advanced. It was by no means certain, however, whether 1987 investment in mineral industry ventures would top the levels of 1986, when, in the case of petroleum industry investment expenditures there had been a sharp decline, this in contrast to evidences of a slight upturn in steel industry investment. World crude mineral output value was estimated at more than $1,084 billion, and the value added by minerals industry processing of this material probably raised the total value of the industry's production from primary materials to more than $2,600 billion constant 1983 dollars. Less easy too assess was the value of mineral commodities moving in international trade, but with a resurgence in oil prices from the 1986 levels, an increase above the 1986 $500 billion mark seemed assured. There are no comprehensive aggregate statistics on mineral consumption comparable to those on production and trade, but quantitative growth recorded for most major commodities suggested a favorable trend, particularly when coupled with a general (though by no means universal) upturn in unit prices.

Almost without doubt, the single mineral-industry-related event to evoke the greatest amount of general world press coverage was the intensification of the tanker war in the Persian Gulf, where both Iran and Iraq were struggling to bring the other protagonist to its knees economically as well as militarily. However, the resulting U.S. Navy tanker convoys and related international efforts to check minelaying by the opponents managed to keep the Gulf open to international shipping, even though voyages were not peril-free. As a result, although oil prices increased somewhat until midyear, feared leaps did not materialize. To the contrary, a sharp downtown set in, virtually wiping out gains registered earlier in the year. The prolonged conflict showed little signs of abatement through yearend, and it continued to have a distinct impact on overall world economics and on mineral economics in particular. Because both warring states were financing their military endeavors almost exclusively on oil revenues, they had to produce and sell increasing quantities of oil in an oversupplied market. By yearend, Saudi Arabia, the world's leading crude oil exporter, had indicated that it was unwilling to further reduce its own exports to compensate for added production, chiefly by Iran and Iraq.

Already, adjustments had been made by the Organization of Petroleum Exporting Countries (OPEC), chiefly Saudi Arabia, to permit Ecuador to exceed its agreed-upon quota to assist that country in coping with financial setbacks arising from the devastating earthquakes of March 1987 without leading to over production, but in the face of output above quotas by several other OPEC members, the Saudis took the position that others should join in the cutback effort. Any cutback by most OPEC states, of course, was fraught with internal problems, such as layoffs, business failures, and the inability to pay international debts, conditions which could ultimately lead to governmental instability.

Not only did the Iran-Iraq war adversely

affect the world oil industry, but it significantly retarded development of other components of these two countries' economies, including other mineral industry ventures. Personnel who could have been engaged in industrial operations were serving in the military, funds that could have been expended for expansion of industry were directed to acquisition of military equipment, and additional funds that could have been expended for development were devoted to restoration of war-damaged installations.

Elsewhere, conflicts such as that between the Soviet-backed central Government of Afghanistan and dissident citizens of that country, guerilla warfare in Angola and Mozambique in Africa, in Nicaragua and neighboring Central American countries, and in the Mediterranean Near East boded ill for economic development. Hardly less serious, and very possibly of greater impact on mineral industry development around the world, was the financial situation of many countries, where soaring debts on previous investment programs made potential investors very wary. Mineral storehouses such as Brazil and Mexico were finding difficulties in attacting additional investment dollars.

Second only to the Persian Gulf war in terms of general press coverage of events affecting world mineral supply probably was the situation in the Republic of South Africa. Here, the output of some export commodities, most notably gold, chromite, manganese ore, and diamond, fell during 1987, but by no means did South African production of all commodities drop. The direct immediate impact on the industrial economy was difficult to assess, as were possible longer term effects from these changes.

Natural disasters, too, had a negative role in world mineral economics. Most notable probably was the Ecuadorean earthquake already mentioned under the discussion of OPEC's crude oil production quotas. Not only was this a setback to oil production, but it had a generally damaging effect on the overall economy of the country, diverting human effort and economic resources to the essential humanitarian aid from industrial expansion and development.

A few words seem in order relative to the Soviet Union and its motions toward "glasnost" and "perestroika." Through yearend 1987, the doctrine of glasnost, heralded as one of a greater degree of open discussion, did not seemingly penetrate to the realm of amplified reporting on mineral commodity production, trade, and consumption. As a result, changes that might have occurred under the concept of perestroika—the concept that economic mechanisms can be modified to make industrial activity more responsive to market forces—were essentially unreported, at least insofar as mineral industry activities were concerned. This is not to make light of these announced Soviet goals, but only to point out that as yet, progress in these directions in the country's mineral industry is generally not apparent. However, there were some reflections of possible change. For example, the Soviet press itself devoted attention to the aftermath and restoration efforts associated with the Chernobyl nuclear disaster, including the fact that underground miners in considerable numbers were employed in the process of entombing the reactor that ran amok. The area beneath the installation was excavated and filled with shielding material in an effort to reduce the escape of radioactivity from the site. Although it certainly can be argued that such reporting clearly has propagandistic value, it must also be noted that it could have been suppressed.

PRODUCTION

The estimated value of world crude mineral production in 1987 exceeded $1,084 billion, 3.4% above the revised 1986 level, but still substantially below the historic high set in 1980, as shown in the following tabulation. The table is based heavily upon the data for 53 mineral commodities compiled for and published in the authoritative French language mineral industry journal Annales des Mines for the year 1983.[3]

Year	Value of 53[1] major crude mineral commodities[2] (billion current dollars)	Billion constant 1983 dollars	
		Value of 53[1] major crude mineral commodities[2]	Value of all crude mineral commodities[3]
1950	25.9	103.5	117.9
1953	37.0	135.1	155.3
1958	50.0	173.5	208.5
1963	59.0	192.0	235.3
1968	77.9	222.3	269.8
1973	159.2	357.3	430.0
1978	477.0	728.5	824.1
1979	656.5	901.2	1,006.5
1980	902.9	1,094.6	1,207.1
1981	912.0	1,008.1	1,097.9
1982	902.9	938.1	1,009.1
1983	930.4	930.4	988.7
1984	991.4	956.4	1,016.3
1985	1,017.6	953.4	1,013.1
1986	1,081.0	986.2	1,047.9
1987	1,155.7	1,020.2	1,084.1

[1]The list of commodities included appears in table 3 of the 1985 edition of this chapter; one commodity covered in 1950-68 (beryl) is excluded from the 1973-87 figures, but the overall impact of this omission is regarded as insignificant.

[2]Data for 1950, 1953, 1958, 1963, 1968, 1973, 1978, and 1983 are as reported in Annales des Mines,. July-Aug.-Sept. 1985, p. 9. Data for 1979-82 have been derived from figures appearing in Annales des Mines, Nov.-Dec. 1981, pp. 198-199; Oct.-Nov. 1983, pp. 210-211; and Nov.-Dec. 1984, pp. 206-207, using appropriate price deflators. Constant dollar data for 1984-86, inclusive, are extrapolated from the 1983 Annales des Mines figures on the basis of the United Nations index of extractive industry production in the United Nations Monthly Bulletin of Statistics, May 1987, p. 256. Current dollar data for 1985-87, inclusive, are computed from the constant dollar extrapolated figures using the reciprocals of the most recent available implicit price deflators.

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

Using the data in the foregoing tabulation and appropriate price inflators, the estimated 1987 value of total world crude mineral production is $1,228 billion in 1987 dollars, or 6.7% above the 1986 value of almost $1,151 billion in terms of 1986 dollars.

Any presentation such as the foregoing, however, which reflects only the value of crude mineral production, falls far short of adequately depicting the role of the entire mineral industry in the world economy. Such a presentation shows only the value of these materials as they are extracted from the earth, with nothing to reflect the very substantial value added to these materials through downstream processing such as beneficiation, smelting, and refining, even though this processing takes place within facilities commonly accepted as mineral industry plants. Comprehensive world data on the value added by such processing are not available, but a total on the order of $2,600 billion (constant 1983 dollars) would be a conservative estimate of the value of the products derived wholly from primary or newly mined materials by the world's mineral industry plants. To evaluate the full worth of the products of these plants would require the addition of a further (and in this case unestimated) increment for the products derived from secondary raw materials—scrap and other reclaimed substances.

It should be stressed that crude and processed mineral commodities constitute not only the overwhelmingly dominant share of the total raw materials supply for all manufacturing operations, but also, in the form of fertilizers and other soil-treatment materials, an indispensible raw material to ensure continued high production and productivity by the agricultural-forestry sector of the world economy. Moreover, the mineral industry, through its output of the various fuel materials, provides the dominant share of the energy required not only for the processing of both other minerals and agricultural products, but also for the transport of minerals and agricultural products from their crude form through the manufactures derived therefrom, as well as for the transportation of most of mankind about this planet. Even that energy derived from hydroelectric and geothermal sources could not be produced and distributed without power generation and distribution equipment fabricated from copper, steel and other metals.

PRODUCTION INDEX PATTERNS

The following tabulation summarizes the development pattern in the world extractive mineral industry output over recent years, as reflected by United Nations industrial production indexes:

Year	Index numbers (1980=100)			
	Coal	Crude petroleum and natural gas	Metals	Extractive industry total
Annual averages:				
1978	r93.4	104.4	97.5	101.8
1981	100.3	89.0	r100.2	92.1
1982	r102.4	80.6	r96.4	r85.7
1983r	101.7	79.4	97.1	85.0
1984r	100.7	82.5	103.7	88.2
1985r	105.9	79.5	107.8	87.1
1986r	108.6	82.6	109.2	90.1
1987	109.4	85.4	113.7	93.2
Quarterly results:				
1986:				
1st quarterr	109.8	83.6	107.6	90.2
2d quarterr	108.4	81.7	111.1	89.8
3d quarterr	106.5	84.1	107.8	90.9
4th quarter	109.7	81.1	110.1	89.3
1987:				
1st quarter	107.9	82.3	111.2	89.9
2d quarter	108.3	83.9	114.1	92.0
3d quarter	107.7	88.7	112.9	95.6
4th quarter	113.8	86.5	116.8	95.3

rRevised.

Source: United Nations. Monthly Bulletin of Statistics. V. 42, No. 8, Aug. 1988, p. 256.

The foregoing tabulation incorporates a number of revisions from the corresponding version published in the previous issue of this chapter, but the revisions, at least for the annual extractive industry aggregates, altered only the magnitude of change from year to year and not the direction of the trend. In the case of the quarterly results for 1986, receipt of additional data and/or reappraisal of earlier information resulted in an alteration of the trend for the crucial crude petroleum and natural gas indexes from that of an upturn in the fourth quarter to that of a significant downturn. This alteration was sufficient to drive the index for the aggregate down in the fourth quarter.

The 1987 results show that the extractive industry registered gains across the year as a whole in each of the listed components and in aggregate. On a quarterly basis, coal extraction registered its more-or-less traditional slump in the third quarter, and the petroleum and natural gas component suffered a weakness in the fourth quarter that was of sufficient magnitude to drive the aggregate downward in that quarter despite very favorable performance by the coal and metals sectors.

Comparison of the data in the foregoing tabulation with that in the following tabulation of indexes from the same source for certain processing sectors of the mineral industry demonstrates that the development of output in the processing sectors does not necessarily parallel that in the crude extractive sectors. For example, the chemicals, petroleum, coal and rubber products processing sector recorded gains in each year from 1983 through 1987, whereas coal extraction logged downturns in 1983 and 1984, and crude petroleum and natural gas recorded downtowns in 1983 and 1985. Similarly, the base metals processing sector registered downturns in 1982 and 1986, whereas the metals extraction sector recorded growth in every year after 1982. Annual and quarterly results for the processing industries were as follows:

Year	Index numbers (1980=100)		
	Non-metallic mineral products	Chemicals, petroleum, coal, rubber products	Base metals
Annual averages:			
1978	r95.8	95.6	99.5
1981	98.0	r100.8	r99.1
1982r	94.6	99.8	89.5
1983	96.8	r105.2	r91.9
1984r	100.4	111.6	99.6
1985r	101.4	115.0	100.7
1986	104.8	119.6	99.0
1987	107.6	125.2	102.9
Quarterly results:			
1986:			
1st quarterr	98.2	117.8	102.2
2d quarter	r108.0	120.3	r101.8
3d quarterr	106.4	118.8	94.9
4th quarter	106.4	121.5	97.1
1987:			
1st quarter	100.2	122.0	100.6
2d quarter	110.4	125.6	104.2
3d quarter	109.3	125.7	100.8
4th quarter	110.6	127.7	106.0

rRevised.

Source: United Nations. Monthly Bulletin of Statistics. V. 42, No. 5, May 1988, p. 257.

On a quarterly basis, base metals processing did mirror the downturn in metals extraction recorded for the third quarter, but neither the fourth-quarter downturn in crude petroleum and natural gas extraction and the traditional third-quarter slump in coal production were sufficient to result in a downturn by the chemicals, petroleum, coal and rubber products sector at any point in 1987. Noteworthy was the 1987 performance of the nonmetallic minerals processing sector, which after a rather pronounced slump between the final quarter of 1986 and the first quarter of 1987 showed a very considerable growth throughout 1987.

Both of the foregoing tabulations of indexes reflect the aggregation of results from world areas that individually showed quite variable results, both from area to area and across the years from quarter to quarter and sector to sector. For these regional details too extensive to include here, the reader is referred to the source publication for these tables.

QUANTITATIVE COMMODITY OUTPUT

Of the 97 distinct mineral commodities and/or subdivisions of mineral commodities for which total world production, as measured by the U.S. Bureau of Mines, is presented in table 1 for 1983-87,[4] 65 registered increases in 1987 relative to the 1986 level of production and 32 recorded declines. These 1987 results were significantly improved over those of 1986 when gains over 1985 output levels were registered for only 52 commodities, and were essentially on a par with those of 1985 when increases were logged for 64 commodities as well (but 1 commodity in 1985 was even with its 1984 level, leaving 32 recording declines, while in 1987, 33 registered declines). In 1984, as the global industry emerged from the extremely bad years of 1982 and 1983, a total of 83 commodities logged gains over 1983 production levels (based on recently revised data for these years), while 1 registered no change and 13 recorded declines.

Of the 65 commodities for which output increases were recorded between 1986 and 1987, 29 registered declines between 1985 and 1986, 11 showed gains for the second year in a row, 15 recorded increases for a fourth consecutive year, 2—mine copper and nitrogen—recorded increases for the fifth consecutive year, and 8 showed continuous increases for 6 years or more. The latter group included gem diamond, industrial diamond, byproduct sulfur, anthracite and bituminous coal, each of which logged increases for 6 years; gold with continuous growth for 7 years, cement with continuous growth for 12 years, and lignite coal, for which gains in output have been continuous for 15 years.

Of the 32 commodities for which declines were recorded in 1987, 17 had shown increases in 1986 with respect to 1985, including notably secondary smelter copper, for which the drop in 1987 was the first in 8 years; feldspar, for which the decline was the first in 11 years, and natural gas liquids, which had shown gains for 12 previous years. Thirteen commodities among those registering declines in 1987 had recorded declines in 1986 as well, following increases between 1984 and 1985; and two—ferroalloys and smelter tin—logged declines for the third consecutive year.

Of the 50 listed metallic commodities, 30 recorded increased production in 1987, while output of 20 fell. Despite growth in production of iron ore, pig iron, and crude steel, production of the two major ferroalloying ores, chromite and manganese, turned downward, as did that of three minor ferroalloying metal ores, columbium-tantalum, molybdenum, and tungsten. Nickel, used both in ferroalloying and in other applications, advanced in both the mine and product stages. Although output of aluminum advanced at all stages of production (bauxite, alumina, and ingot metal), production of the other key light metal, magnesium, was reduced. Among the major traditional nonferrous metals, output of copper advanced at each major stage of recovery (mining, smelting, and refining), but in both of the metallurgical stages, the increase was the result of higher primary production that offset reductions in recovery from scrap. Similarly, in the case of lead, output was higher at each of the three stages of recovery in 1987, but in this case, the advance in refined metal production was the result of a higher level of secondary recovery, while recovery from ores was marginally lower. Zinc production was higher at both the mine and smelter stage, while mine tin output advanced slightly in contrast to a slight drop in smelter production. All three precious metals categories—gold, silver, and platinum-group—registered gains, but the percentage growth for gold was well below that of the other two, as well as below that logged for the yellow metal between 1985 and 1986. The very modest increase in gold output in 1987 was the result of mixed performance by leading producing countries; first-ranked

Republic of South Africa suffered a 6.3% reduction in output, while third-, fourth-, and fifth-ranked United States, Canada, and Australia recorded increases of 33%, nearly 13%, and 44%, respectively, with output in the U.S.S.R. estimated at the same level as in 1986, and production by all other producers more or less unchanged in aggregate.

Of the 36 nonmetallics grouped under the heading "Industrial Minerals," 26 recorded production increases between 1986 and 1987, with the remaining 10 recording declines. Among those registering gains were the three key fertilizer commodities: ammonia, phosphate rock, and potash (the last two showing upturns after recording declines between 1985 and 1986); the bellwether construction materials, cement and gypsum; and the most significant chemical industry materials, salt and sulfur. In the case of the latter, output of Frasch and other elemental sulfur produced in its own right, and output of sulfur in pyrite declined, but these drops were more than offset, albeit only slightly so, by increased recovery of byproduct sulfur. Also notable was the upturn in output of both gem and industrial diamond, this as in the previous year almost entirely as a result of expanded production in Australia, which in just 5 years has expanded output from an almost inconsequential 457,000 carats in 1982 to 30.3 million carats, placing the country in undisputed first rank among producers.

The overall performance of the nonfuel mineral industry can only be summarized in terms of value of production, and for these commodities, exactitudes on a worldwide basis on a commodity-by-commodity basis are not available for any year subsequent to 1983 (see "Value of World Mineral Production"). Among fuel commodities, however, the overall pattern of output level changes and their interrelationships can be demonstrated by United Nations data, in which production results for each of the forms of primary energy are adjusted to a common energy equivalent basis. The following tabulation summarizes world energy commodity output for 1981-86 as reported by the United Nations, and provides U.S. Bureau of Mines estimates for 1987:

Year	Million metric tons of standard coal equivalent					
	Coal	Crude petroleum and natural gas liquids	Natural gas	Primary electricity		Total
				Hydro and geothermal	Nuclear	
1981	2,635	4,250	1,859	220	99	9,063
1982	2,712	4,027	1,844	226	107	8,916
1983[r]	2,719	3,982	1,856	237	124	[1]8,917
1984[r]	2,839	4,044	1,990	245	150	9,268
1985[r]	2,965	4,011	2,052	249	179	[1]9,455
1986	3,071	4,222	2,103	253	191	[1]9,839
1987[e]	3,159	4,231	2,255	257	200	10,102

[e]Estimated. [r]Revised.
[1]Data do not add to total shown because of independent rounding.

Sources: 1981—United Nations. 1984 Energy Statistics Yearbook. New York, 1986, p. 2; 1982—United Nations. 1985 Energy Statistics Yearbook. New York, 1987, pp. 2, 380; 1983-86—United Nations. 1986 Energy Statistics Yearbook. New York, 1988, pp. 2, 378; and 1987—U.S. Bureau of Mines estimates.

It is perhaps noteworthy that the published United Nations results for 1986 in the foregoing tabulation were quite close to Bureau estimates made for inclusion in the 1986 edition of this chapter well over 6 months prior to publication of the United Nations data. Estimated 1986 coal output was 1.1% below the figure ultimately reported, estimated crude petroleum and natural gas liquid output was only 0.3% below the reported figure, estimated natural gas production was 0.2% below the United Nations published number, estimated hydroelectric power output was only 0.8% above the ultimately reported level and the estimated aggregate energy output was only 0.3% below the published United Nations total. Only in the case of nuclear generation of electricity was there a significant difference; actual output was 6.8% below the Bureau's estimate, this in part because some facilities expected to come on-line in 1986 were delayed. For 1987, the estimated aggregate exceeded the reported 1986 figure by almost 2.8%, chiefly as a result of increases of 2.9% and 7.2%, respectively, for coal and natural gas. The increase in crude petroleum and natural gas liquids output at only 0.2% perhaps reflected more than anything the near 25% increases in output by Iran and Iraq, both clutching for funds to finance the continuation of their war; out-

put by all other producers in aggregate fell by 1.3% between 1986 and 1987, led by a nearly 17% decline in output by Saudi Arabia, this occasioned by an effort to reduce the supply in a glutted market. The small growth estimated for hydroelectric and geothermal power reflected the high capital investment costs required to achieve a measurable increment of growth in output, while the small growth in nuclear power generation was more indicative of the impact of the 1986 Chernobyl disaster, this not so much from the permanent loss of the single reactor and the temporary shutdown of the adjacent units at Chernobyl, but rather from a worldwide more cautious attitude toward these plants, not only those in operation but also those due on-stream.

VALUE OF WORLD MINERAL PRODUCTION

The value of world crude mineral production in 1987 was estimated at $1,084.1 billion in constant 1983 dollars, or $1,228.1 billion current (1987) dollars. Details on the methodology employed to prepare this estimate are summarized in the 1985 edition of this chapter, to which the reader is referred.

GEOGRAPHIC DISTRIBUTION OF WORLD MINERAL OUTPUT VALUE

Available information is inadequate to reliably extrapolate to 1987 the 1983 data on geographic distribution of world crude mineral output value published in the July-September 1985 edition of Annales des Mines, and reproduced in summary form in the 1985 edition of this Minerals Yearbook chapter. These data for 1983 appear in the 1985 "Minerals in the World Economy" chapter (table 2) together with corresponding figures for 1950 and 1978, and with some textual comments on this material. The reader is referred to this publication, as well as to its original source, for further information.

COMMODITY DISTRIBUTION OF WORLD MINERAL OUTPUT VALUE

As was the case with geographic distribution of world mineral output value, the inadequacy of data precludes any reliable extrapolation to 1987 of the various commodities' shares of the totals shown for 1983 in the 1985 edition of this chapter. Clearly some major shifts in percentage shares, if not in ranking, will have occurred as a result of unit price changes such as in the cases of crude oil and gold, to cite but two of the more notable commodities. For details on the 1983 distribution of the total, the reader is referred to the 1985 edition of this chapter, particularly to table 3, and to the source publication for that table.

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

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Bauxite, gross weight[2] thousand metric tons	78,687	87,799	84,496	86,093	90,302
Alumina, gross weight do	29,276	33,442	31,588	32,936	34,539
Unalloyed ingot metal do	13,904	15,714	15,367	15,341	16,016
Antimony, mine output, Sb content metric tons	50,856	54,698	56,601	58,291	56,242
Arsenic, trioxide[3] do	42,126	48,402	54,731	56,513	45,840
Beryl concentrate, gross weight[3] do	9,143	8,929	8,125	8,971	8,598
Bismuth[4] do	3,979	3,743	4,738	3,953	4,080
Cadmium, smelter do	17,636	19,463	18,723	18,525	18,566
Chromite, gross weight[3] thousand metric tons	8,211	9,776	10,514	11,090	10,987
Cobalt:					
Mine output, Co content metric tons	37,877	41,113	48,311	49,082	46,757
Metal, refined do	18,088	23,613	26,901	30,676	26,964
Columbium-tantalum concentrate[3 5] do	21,146	33,412	35,632	34,775	31,952
Copper:					
Mine output, Cu content thousand metric tons	7,659	7,999	8,080	8,125	8,475
Metal:					
Smelter:					
Primary[6] do	7,504	7,674	7,759	7,797	7,874
Secondary[7] do	616	717	905	917	833
Refined:					
Primary[6] do	7,816	7,862	7,919	8,080	8,219
Secondary[7] do	1,386	1,254	1,456	1,432	1,428
Gold, mine output, Au content thousand troy ounces	45,163	46,827	49,184	51,620	52,481

See footnotes at end of table.

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

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS —Continued					
Iron and steel:					
Iron ore, iron ore concentrates, iron ore agglomerates, gross weight thousand metric tons	740,051	835,830	858,011	868,392	883,098
Metal:					
Pig iron do	462,291	495,554	504,695	501,777	511,500
Ferroalloys do	13,008	14,948	14,907	14,715	14,682
Steel, crude do	662,975	710,245	716,630	710,342	729,500
Lead:					
Mine output, Pb content do	3,357	3,262	3,428	3,376	3,454
Metal:					
Smelter:					
Primary do	3,248	3,176	3,401	3,277	3,311
Secondary do	1,997	2,247	2,187	2,264	2,336
Refined:					
Primary do	3,265	3,161	3,370	3,229	3,177
Secondary do	2,024	2,295	2,292	2,354	2,453
Magnesium metal, smelter, primary metric tons	260,612	326,795	319,579	328,694	321,876
Manganese ore, gross weight thousand metric tons	21,906	23,701	24,275	23,690	22,723
Mercury, mine output, Hg content 76-pound flasks	180,835	195,031	197,688	179,263	178,800
Molybdenum, mine output, Mo content metric tons	63,990	97,460	98,479	92,565	84,960
Monazite concentrate (source of rare-earth metals and thorium) do	26,044	29,313	30,887	28,541	25,704
Nickel:					
Mine output, Ni content thousand metric tons	674	769	801	757	785
Metal, plant output do	646	712	729	781	809
Platinum-group metals, mine output, metals content thousand troy ounces	6,525	7,653	7,941	8,314	8,671
Selenium, smelter[3 5] metric tons	1,403	1,494	[4]1,325	[4]1,194	[4]1,245
Silver, mine output, Ag content thousand troy ounces	387,711	413,930	422,093	415,929	429,091
Tellurium, smelter[3 4 5] metric tons	87	100	100	85	90
Tin:					
Mine output, Sn content do	196,942	198,463	188,635	179,377	179,713
Metal, smelter do	200,124	201,555	197,836	191,403	189,556
Titanium concentrate, gross weight:					
Ilmenite[4 8] thousand metric tons	2,679	3,481	3,536	3,395	3,691
Rutile[3 4] do	315	341	373	392	450
Titaniferous slag do	1,052	1,143	1,280	1,285	1,985
Tungsten, mine output, W content metric tons	40,925	46,148	46,513	42,656	40,232
Uranium, mine output, U_3O_8 content[3 5] do	43,921	43,811	40,957	43,593	43,557
Vanadium, mine output, V content do	29,508	33,290	33,352	32,418	37,415
Zinc:					
Mine output, Zn content thousand metric tons	6,283	6,524	6,801	6,829	7,144
Metal, smelter:					
Primary[6] do	5,887	6,166	6,500	6,440	6,686
Secondary[7] do	362	360	352	321	343
Zirconium concentrate[4] do	667	736	814	760	747
INDUSTRIAL MINERALS					
Asbestos do	4,429	4,309	4,272	4,050	4,054
Barite do	5,380	5,815	6,039	4,725	4,662
Boron minerals do	2,235	2,518	2,474	2,436	2,629
Bromine[3] do	364	397	381	374	384
Cement, hydraulic do	916,392	939,070	958,591	999,680	1,033,408
Clays:[3]					
Bentonite do	8,099	8,828	8,787	8,802	8,690
Fuller's earth[5] do	2,208	2,319	2,368	2,212	2,397
Kaolin do	19,586	20,631	22,324	23,347	24,064
Corundum, natural metric tons	14,633	9,213	9,248	9,717	9,241
Diamond:					
Gem[e] thousand carats	23,039	26,093	26,233	39,012	39,295
Industrial[e] do	32,353	37,359	39,781	52,744	53,734
Total do	55,392	63,452	66,014	91,756	93,029
Diatomite[3] thousand metric tons	1,699	1,750	1,834	1,853	1,821
Feldspar[3] do	3,954	4,238	4,453	4,610	4,531
Fluorspar do	4,236	4,797	4,923	4,748	4,762
Graphite[4] metric tons	604,206	627,549	564,816	669,187	629,315
Gypsum thousand metric tons	80,690	85,016	85,592	86,498	89,445
Iodine metric tons	12,591	12,488	12,784	12,971	12,706

See footnotes at end of table.

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

Commodity	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Lime[3] thousand metric tons	110,142	113,617	111,845	109,833	111,431
Magnesite[4] do	12,169	12,819	14,615	14,801	14,935
Mica[3] do	243	276	255	289	298
Nitrogen: N content of ammonia do	80,382	87,957	89,546	90,148	93,004
Perlite do	1,545	1,634	1,629	1,631	1,655
Phosphate, gross weight:					
Phosphate rock do	140,889	151,568	148,606	138,740	145,148
Thomas slag do	2,384	2,637	2,515	2,038	2,254
Guano do	6	6	9	14	13
Potash, marketable, K_2O equivalent do	27,418	29,334	29,151	28,758	29,812
Pumice[3 5] do	11,502	11,611	10,737	10,357	10,661
Salt do	158,844	172,158	173,031	176,580	182,623
Sodium compounds, n.e.s.:[3]					
Carbonate do	27,892	28,251	28,061	28,285	29,416
Sulfate do	4,232	4,245	4,332	4,508	4,540
Strontium minerals[3 5] metric tons	151,563	140,055	169,094	149,451	183,707
Sulfur, elemental basis:					
Elemental[9] thousand metric tons	12,701	14,038	15,105	14,396	13,978
From pyrites do	9,054	8,725	9,191	9,186	8,900
Byproduct[10] do	28,015	29,096	30,035	30,492	31,343
Total do	49,770	51,859	54,331	54,074	54,221
Talc, soapstone, pyrophyllite do	7,061	7,534	7,648	7,496	7,550
Vermiculite[3 5] metric tons	444,172	494,022	504,486	524,750	545,190
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[3 5] thousand metric tons	4,295	4,347	4,441	4,370	4,450
Coal:					
Anthracite million metric tons	298	318	337	344	355
Bituminous do	2,665	2,799	2,963	3,041	3,129
Lignite do	1,047	1,108	1,157	1,180	1,212
Total do	4,010	4,225	4,457	4,565	4,696
Coke:[11]					
Metallurgical thousand metric tons	330,011	340,719	348,969	344,493	349,141
Other do	11,681	11,851	12,164	12,129	11,793
Gas, natural, marketed billion cubic feet	54,041	60,019	62,022	63,476	68,074
Natural gas liquids[3] million 42-gallon barrels	1,439	1,626	1,612	1,638	1,610
Peat thousand metric tons	220,366	212,578	206,545	213,146	228,535
Petroleum:					
Crude million 42-gallon barrels	19,333	19,838	19,581	20,400	20,475
Refined do	20,640	22,412	21,510	22,038	22,241

[e]Estimated. [p]Preliminary.

[1]Incorporates numerous revisions from the corresponding table in previous editions of this chapter. Figures generally conform to those published in appropriate commodity chapters of volume I of the "Minerals Yearbook," 1987 edition.

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

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

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

[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]Includes leucoxene.

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

[10]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.

[11]Production of coke other than metallurgical by China and the U.S.S.R. is included with "Coke: Metallurgical."

TRADE

In 1986, the aggregate value of total world international trade in mineral commodities was estimated at $499.7 billion, about 18.7% below the 1985 level, and 37.6% below the record high set in 1980. Comparable data for 1987 were not available in time for inclusion in this chapter. Incomplete returns suggest that the 1987 level may prove to be somewhat higher than that for 1986 if increases in crude petroleum and petroleum product prices registered through August are not more than counterbalanced by declines through yearend. A data series for the estimated value of all international trade in mineral commodities for 1980-86 inclusive appears in the following tabulation, which also demonstrates the general trend of decline in value since 1980 (there was a slight resurgence in 1984 according to latest available data), as well as the declining share of total commodity trade accounted for by mineral commodities:

Year	Estimated value of all mineral commodities traded (million current dollars)	Change from previous year (percent)	Mineral commodities' share of all commodities traded (percent)
1980	$800,500	+37.7	40.0
1981	764,600	-4.5	38.9
1982	693,900	r-9.2	37.5
1983	r631,500	-9.0	34.8
1984r	633,200	+.3	33.2
1985r	615,000	-2.9	31.8
1986	499,700	-18.7	23.6

rRevised.

What the foregoing table cannot illustrate is that the entire decline in total mineral commodity trade value from 1983 onward is the result of the diminishing value of energy materials traded. This can be seen in table 2, which provides reported data on the value of trade for major groups of mineral commodities as well as the value of total commodity trade for 1981-86 inclusive, and which incidentally, serves as the basis for the foregoing estimates of total mineral commodity trade. From this table, it is apparent that the aggregate value for the groups of nonfuel mineral commodities shown has advanced steadily since 1983—up 5.5% in 1984 with respect to 1983, up 1% in 1985 with respect to 1984, and up 3.2% in 1986 with respect to 1985—while the year-to-year changes in mineral fuels were constantly down; 1.5% between 1983 and 1984, 4.3% between 1984 and 1985, and a prodigious 27.2% between 1985 and 1986. The distribution of the value of major world mineral commodity exports by commodity groups for 1981-86 is shown in table 2, and table 3 shows the percentage changes for each of these groups from year to year. It should be noted that the source publications for table 4 provide considerable detail on the geographic pattern of world trade in these commodities, and may be of considerable use to readers interested in regional analysis.

CONSUMPTION

NONFUEL MINERAL COMMODITIES

Available statistics on 1987 worldwide consumption of selected major nonfuel minerals shown in table 5 all show increases over the levels attained for 1986. Although these 1987 results are to a significant extent the results of estimates for a number of countries that are subject to change in the next year as more complete results are obtained, it is believed that the pattern of rising consumption of these major products will be preserved when the more complete results become available. It should be noted, however, that percentage growth rates that could be calculated from these data may well be subject to change.

In the case of the ferrous metal materials measured, the consumption of both iron ore and iron and steel scrap advanced as functions of increased output of pig iron and crude steel; in the case of iron ore there were indications that world inventories of ore declined somewhat as the growth rate logged for consumption exceeded that for production. The upturn in scrap consumption roughly matched the increase in steel output on a percentage basis, suggesting that there would be little if any change in the ratio of iron ore to scrap as furnace charges on a global basis.

Before summarizing on the nonferrous metal use situation, it is essential to comment on the nature of some of the data published. Examination of table 5 shows that separate statistics have been provided for market economy countries and centrally planned economy countries. This has been done for two reasons. First, the consumption trends from year to year for these two groups of countries often differ, in that the trends in market economy countries are influenced to a significant extent by variations in the economies of the countries included, while the trends in centrally planned economy countries are the result of rigid economic planning. Second, however, and perhaps more importantly, the consumption figures for the centrally planned economy countries are universally apparent consumption figures—that is, they represent the sum of production (often estimated) and imports minus exports, plus or minus variations in stocks (where such information is available). As such, any change in the level of any of these component figures will result in a change in the calculated apparent consumption, and for several commodities in this group there are differences between production estimates by the U.S. Bureau of Mines and those by Metallgesellschaft AG, the source of these consumption figures. Hence, the consumption numbers provided here would differ if Bureau production numbers were substituted in the formula. For instance, substitution of the Bureau's estimates for refined copper output for 1987 would lower the centrally planned economy countries consumption by 464,000 tons. Similar but smaller reductions would result for lead and zinc, but results for aluminum, cadmium, magnesium, nickel, and tin would be but little altered.

Bearing the foregoing in mind, and as a result considering the consumption data for the centrally planned economy countries as a measure more of year-to-year trends than of precise quantities of materials consumed, one can examine consumption changes and their relationships to production changes. In the case of all of the commodities listed except zinc, the level of consumption increased by a larger percentage than did metal output, suggesting a reduction of inventories. In the case of zinc, the opposite was true, with metal output rising proportionally more than consumption. Examining the relative performance of the two groups of countries, the market economy countries showed larger growth rates for all nonferrous commodities listed between 1986 and 1987 than did the centrally planned economy countries, and indeed in the case of tin and zinc, the latter group registered declines.

Considering finally the fertilizer materials and sulfur, all showed gains in consumption levels in 1987. Nitrogenous fertilizers continued a steadily upward pattern dating back for a number of years, while phosphatic and potassic fertilizers and sulfur reversed their 1985-86 downturns.

MINERAL FUEL COMMODITIES

Mineral fuel consumption, shown in table 5 in terms of standard coal equivalent (SCE) to facilitate interfuel comparisons, advanced again in 1987 to a record high. Indeed, the growth rate in terms of total energy consumption was greater than that between 1985 and 1986 or between 1984 and 1985. Considering the relative share of total

energy provided by each energy source listed, solid fuels in 1987 lost a very small fraction, liquid fuels suffered a slightly greater loss, and primary electricity lost marginally, with all of the losses being to natural gas, which registered not only a quantitative gain, but a gain in share of the total as well. It seems noteworthy that although total energy consumption reached a new peak in 1987, the liquid fuel component had yet to reach the level that it attained in 1979, a total of 3,947 million metric tons SCE.

INVESTMENT

Comprehensive world mineral industry investment data do not exist, but limited material published on aggregates of investment in some elements of the world mineral industry suggest a downturn in the investment level, at least in market economy countries in 1987. Steel industry investments in Organization for Economic Cooperation and Development (OECD) countries are not yet available for 1986 but, as shown in table 6, increased by only 5% in 1986 for the organization as a whole, with Turkey and the United States showing significant decreases in their investments for the year, with decreases of 30.5% and 47.4%, respectively. For the rest of the OECD, significant increases by Australia (262%), Canada (53.6%), and Japan (42.2%) were not matched by the countries of the European Economic Community (EEC) and the European Free Trade Association (EFTA). Investment in the steel industries of the EEC members remained stable while similar investment increased by 7.8% in the member countries of EFTA. In the Latin American countries, increased investments in the steel industries of Argentina, Chile, and Venezuela were not large enough to offset the large decreases in the investment levels in Brazil, Colombia, Mexico, and Peru. The decrease of 27.8% in 1986 in the investment level in the steel industries of the Latin American countries continues the trend of the past 3 years but is larger than the decreases of 22% and 21.9% of 1984 and 1985, respectively. If data for the world steel industry as a whole, including those of the centrally planned economy countries, were available, they presumably would show the same pattern as those reported, that is, remaining fairly stable with increases in some countries being offset by decreases in others. However, the lack of comprehensive information on the centrally planned economy countries makes it impossible to determine whether the overall trend was up or down despite recorded increases or decreases in production of the materials involved.

Market economy petroleum industry investment as reported by the Global Energy Component of the Chase Manhattan Bank has been summarized in table 7 of this chapter but only presents information for 1986. However, the information for 1986 shows that the trend of lower and lower investment in the petroleum industry around the world continued in 1986, with an increase only in the Far East and Oceania. The increase of 4% in this area was not significant enough to offset the large drop in the amount invested in the United States (-41.6%), other countries of North America (-30%), and Africa and the Middle East (-18%) as well as the rest of the areas listed, resulting in a decrease in the total amount invested of 26.1% for market economy countries as a whole. The continuing military conflict in the Middle East and high production levels of the oil-producing countries—which resulted in relatively inexpensive crude oil—make it highly unlikely that investment levels in the petroleum industry even reached the level of 1986 much less increased in 1987. With the petroleum industry as with the steel industry, it is almost assured that the investment rate in centrally planned economy countries did not exceed or was otherwise different from the rest of the world.

Data presented on U.S. foreign investment in mineral industry activity are updated to 1987 in table 8 of this chapter. These data show that U.S. direct foreign investment in the petroleum industry continues to rise each year and that in 1987 U.S. direct foreign investment in the mining, smelting, and refining industries also increased (+2.6%), as did the reinvested earnings of foreign affiliates. This latter category showed a dramatic increase in 1987, with reinvested earnings in the smelting and fabricated metals industries almost doubling and those in the petroleum industry increasing more than fivefold. Income, however, in the petroleum industry of this group increased only slightly while the income from the mining, smelting, and refining industries increased by 51.3% over the previous year.

TRANSPORTATION

MARINE TRANSPORT

Bulk carriers, freighters, and tankers are the three classes of marine vessels engaged in transporting mineral commodities. It should be noted that vessels in each of these categories are not devoted wholly to mineral commodity transport. 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 carrying mixed mineral and nonmineral cargoes. Tankers, although largely engaged in moving crude oil and refinery products, also transport liquid chemicals, molasses, wine, and other fluids.

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 quality and types of material moved also significantly affect the shipping sector of the world economy. Unfortunately, comprehensive data in this regard are not available.

Bulk Carriers.—During 1987, the world's bulk carrier fleet decreased by 412 vessels compared with a decrease of 302 vessels during 1986 and an increase off 227 vessels in 1985. During 1987, total deadweight tonnage of bulk carriers decreased by 1.3% compared with a decrease of 3.6% during 1986 and an increase of 4.6% during 1985. The following tabulation shows the distribution of the bulk carrier fleet of the world as of December 31, 1987:

Country of registry	Number of vessels	Deadweight tonnage (thousand long tons)
Panama	895	31,288
Liberia	540	30,461
Japan	367	21,541
Greece	498	18,943
Cyprus	396	14,259
Philippines	248	10,717
China	220	7,124
Korea, Republic of	140	7,093
U.S.S.R.	228	5,696
Italy	83	4,819
Brazil	93	4,809
India	107	4,762
Singapore	80	3,938
Taiwan	53	3,541
Romania	68	2,706
Yugoslavia	77	2,538
Poland	91	2,475
Turkey	60	2,340
Norway	29	2,260
Belgium	24	2,253
Spain	63	2,124
Australia	33	2,019
Iran	52	1,802
United Kingdom	50	1,604
Other	807	33,197
Total	5,302	224,309

Freighters.—The world's freighter fleet decreased in 1987 by 214 vessels compared with a decrease of 1,151 vessels in 1986 and a decrease of 82 vessels during 1985. The total deadweight tonnage of the freighter fleet decreased by 1.6% during 1987 compared with a decrease of 6.1% in 1986 and an increase of 1.4% during 1985. The following tabulation shows the distribution of the world's freighter fleet at the end of 1987:

Country of registry	Number of vessels	Deadweight tonnage (thousand long tons)
Panama	1,681	16,474
U.S.S.R.	1,740	11,878
China	816	8,019
United States	406	7,418
Cyprus	640	5,643
Japan	543	5,186
Liberia	299	4,180
Greece	293	3,568
Germany, Federal Republic of	300	2,834
Singapore	228	2,847
Netherlands	306	2,276
Taiwan	142	2,237
Yugoslavia	176	2,005
India	133	1,890
United Kingdom	117	1,770
Philippines	224	1,691
Korea, Republic of	220	1,643
Denmark	142	1,509
Romania	212	1,468
Italy	206	1,451
Poland	151	1,418
Brazil	146	1,413
Other	3,451	28,119
Total	12,572	116,937

Tankers.—During 1987, the world's tanker fleet increased by 91 vessels as opposed to a decrease of 457 vessels during 1986 and a decrease of 26 vessels during 1985. Continuing the trend to the use of medium-size tankers of the past several years, during 1987 the average gross and deadweight tonnages decreased by 1.5% and 1.7%, respectively. The following tabulation presents the distribution of the tanker fleet of the world at the end of 1987:

Country of registry	Number of vessels	Deadweight tonnage (thousand long tons)
Liberia	616	58,830
Panama	602	20,935
Japan	344	18,056
United States	254	16,877
Greece	207	16,779
Cyprus	127	10,404
Bahamas	107	9,832
Norway	107	7,761
U.S.S.R.	434	6,825
Italy	225	4,918
Singapore	123	4,847
France	66	4,435
Denmark	56	4,122
Spain	90	3,811
Brazil	82	3,511
Iran	28	3,469
Saudi Arabia	61	3,134
India	63	3,022
United Kingdom	92	2,925
Other	1,406	41,413
Total	5,090	245,906

Information that in past years appeared in the British Petroleum Co. PLC (BP) annual publication "BP Statistical Review of World Energy," showing the variations in the world tanker fleet by size categories, was not available at the time of publication of the minerals yearbook and therefore is not included in this chapter. However, according to other sources, the total deadweight tons of tankers and combined tankers (which can carry liquid or bulk cargo) that were being dismantled and melted down to scrap fell to 7.5 million deadweight tons in 1987, one-half the 1986 figure of 15.2 million tons and about one-quarter the 1985 level of 29.3 million deadweight tons. Reportedly, the resale value of large tankers in 1987 was above their scrap metal value, thus preventing scrapping.

Information furnished by the Maritime Administration, an agency of the U.S. Department of Transportation, shows that the average deadweight tonnage of new tankers delivered during 1987 was 51,452 long tons, which continued the trend of the past few years to the use of tankers in the small to medium range. Tankers under construction at the end of 1987 demonstrated the same trend, with the average deadweight tonnage at 64,671 tons. The following tabulation shows, by country of construction, the number of tankers being built or on order at the end of 1987:

Country	Number of vessels	Deadweight tonnage (long tons)
Korea, Republic of	86	9,427,300
Japan	57	4,428,800
Yugoslavia	25	1,309,800
Brazil	19	687,700
Italy	14	223,600
Finland	11	27,500
Romania	10	625,800
Spain	10	322,100
China	9	469,500
Poland	9	418,500
Bulgaria	8	180,800
Denmark	7	339,800
Germany, Federal Republic of	5	46,400
India	3	251,700
Mexico	3	135,000
Belgium	3	117,700
United States	3	91,200
Norway	3	69,500
Argentina	3	18,900
Netherlands	3	10,200
United Kingdom	2	66,400
U.S.S.R.	2	56,600
Indonesia	2	6,800
Taiwan	1	101,400
Portugal	1	87,500
Philippines	1	4,700
Malaysia	1	3,400
Turkey	1	2,100
Total	302	19,530,700

OCEAN FREIGHT RATES

Data on ocean freight rates, last published by the United Nations in its Monthly Bulletin of Statistics for December 1984 have not been updated by that source to provide a continuation of the information normally presented in this section of this chapter. Other sources that report on ocean freight rates, however, show that although rates for dry cargo fluctuated during the year, which is normal owing to seasonal demand, they ended the year, in general, without having changed much. Although the rates themselves fluctuate according to seasonal demand, other factors also determine ups and downs in the rates. Some of these factors are the size of the ship, the availability of different size ships, cost of marine fuel, and the general economic conditions in the importing countries.

Indications also showed that tanker rates generally followed the same fluctuations as those for dry cargo, ending the year generally unchanged. According to media reports, other factors have been added to considerations of ocean freight rates and their impact on international shipping. One of these factors is the toll rates for the Panama and Suez Canals. Higher tolls in these two waterways combined with stable or falling ocean freight rates could be the deciding factors in the routes tankers take. There were reports that tankers sailed around southern Africa rather than use the Suez Canal because lower ocean freight rates and cheaper fuel made the additional mileage more economical than using the canal. Another factor that is becoming more and more apparent is the excess tanker availability. Shipowners sometimes accept rather low rates rather than have the shipping capacity be idle. Reportedly, in October 1973 freight charges of a crude oil cargo on a supertanker voyage from the Persian Gulf to Western Europe amounted to 106% of the value of the cargo; by 1987 the freight rate had plummeted to 3% of the value of the oil.

PANAMA AND SUEZ CANALS

Data on 1987 mineral commodity shipments through the Panama Canal dropped significantly in 1987 as is shown in the following tabulation:

	Fiscal year[1]				
	1983	1984	1985	1986	1987
Number of transits:					
Commercial ocean traffic	11,707	11,230	11,515	11,925	12,230
Other traffic	1,247	1,293	1,251	1,353	1,214
Total	12,954	12,523	12,766	13,278	13,444
Cargo moved (thousand metric tons):					
Commercial ocean traffic:					
Mineral commodities	72,219	72,210	74,128	74,139	69,797
Other commodities	75,708	70,515	66,740	68,052	81,280
Subtotal	147,927	142,725	140,868	142,191	151,077
Other traffic	364	336	265	184	212
Total	148,291	143,061	141,133	142,375	151,289

[1]Year ending Sept. 30 of that stated.

In fiscal year 1987, mineral commodities accounted for 46.1% of all commercial ocean traffic through the Panama Canal, a figure lower than the 52.1% recorded in 1986 and 37.4% lower than the amount moved just 5 years earlier in 1982. Table 10 shows mineral commodity movements through this canal during 1985-87 by major mineral groups.

In terms of major mineral commodity groups, fuels remained dominant in 1987 but were only 49.4% of the total compared with 56.3% of the total in 1986 and 52.5% in 1985. Industrial minerals moved into second place in 1987 with 25.9% of total mineral commodities compared with 21.1% and 23.4% in 1986 and 1985, respectively. Total metals dropped to third place in 1987 with 24.7% of total mineral commodities although they increased by 2.8% over the amount moved in 1986, which was 22.6% of the total mineral commodities moved. Iron and steel ingots and semimanufactures remained the dominant single metals class; fertilizer materials were again the overwhelmingly dominant industrial minerals class; refined petroleum was again for the fourth year the dominant fuel commodity and accounted for slightly more than one-half of the mineral fuels moved through the

Panama Canal during 1987. Mineral commodities moved through the canal during 1987 were at the lowest tonnage level in at least the past 10 years and have been replaced by grains and other agricultural products as the dominant commodity group being moved through the Panama Canal.

In 1987, mineral commodities accounted for 55.5% of all commercial traffic through the Suez Canal, a drop of 6.3% from the amount transited during 1986 and the lowest amount since 1982. The number of transits was also lower in 1987 than any year since 1982. Despite the fewer transits and lower tonnage of cargo moved, the Suez Canal earned Egypt $1 billion in the first 10 months of 1987, up $50 million from a year earlier. An increase in ships' tolls, scheduled for 1988 had been canceled because of the world financial turmoil. The following tabulation shows the number of transits and the total amount of cargo moved through the Suez Canal for the period 1984-87.

	1984	1985	1986	1987
Number of transits:				
Commercial ocean traffic	20,157	18,654	17,183	16,248
Other traffic	1,204	1,137	1,220	1,293
Total	21,361	19,791	18,403	17,541
Cargo moved (thousand metric tons):				
Commercial ocean traffic:				
Mineral commodities	159,020	149,833	152,259	142,565
Other commodities	104,708	107,763	110,193	114,370
Total	263,728	257,596	262,452	256,935

Table 11, which distributes mineral commodity movements through the Suez Canal by commodity and by direction, shows that fuels remained the single largest major group of mineral commodities moved through this canal, with the metals group ranking second and the industrial minerals group ranking third. As in past years, iron ore was the most significant component of the metallic commodity group while fertilizer materials ranked first among the industrial minerals, as was the case for the Panama Canal. Significant decreases were registered during 1987 in the amount of cement moved (down 36.5%) and crude petroleum (down 24.7%) while the amount of coal and coke moved through the canal increased by 68.7%. Greater detail on Suez Canal mineral shipments can be found in the Suez Canal Annual and Monthly Reports.

OVERLAND TRANSPORT

The paucity of detailed information available has prevented detailed study of the overland international transport of mineral commodities. Large-scale international rail shipments of mineral commodities were confined chiefly to movements between the United States and Canada and Mexico and to transfers of materials within Europe south of the Baltic Sea. Notable exceptions continued to be the shipment of large quantities of iron ore from Sweden to Narvik, Norway, for loading onto vessels for export through that port and to the flow of a variety of minerals from several southern African nations through the Republic of South Africa for export through that country's ports.

Major international pipeline movements of crude petroleum and natural gas in 1987 were, in general, confined to the same areas cited as the centers of rail movements of mineral commodities. Noteworthy here, however, was the continuing operation of the pipelines for both oil and natural gas from the U.S.S.R. to the other centrally planned economy countries and on to some market economy countries of Europe. Despite the continued military conflict in the Middle East, more and more reliance was being placed on the movement of crude oil through pipelines, partly a response to the increased military action against tankers in the Persian Gulf, which resulted in a decline in the amount of crude petroleum moved through the Suez Canal in 1987. Construction of new pipelines by Iraq, Saudi Arabia, and Turkey was significantly accelerated in 1987 as a result of the military conflict in the area. Eventually the pipeline system in this area will remove more than one-half of the oil going through the Strait of Hormuz and thus realign the world's oil export situation. At the end of 1987, these

pipelines were already carrying more than 4 million barrels of oil per day that just a couple of years earlier would have been moved by tankers. In 1987, a 40-inch-diameter-pipeline system was opened in Iraq. It now moves 500,000 barrels of oil per day from the oilfields near Basrah to the Kirkuk Oilfields in the northeast of the country, where it connects to an expanded, existing pipeline to Ceyhan, Turkey. This new expansion increased Iraq's pipeline capacity to 1.5 million barrels per day. Additional expansion being worked on was expected to bring Iraq's pipeline capacity before 1990 to at least 6.5 million barrels per day, moving oil to both Ceyhan and to Yanbu in Saudi Arabia. Another pipeline having an impact on tanker shipments is the Trans-Isthmus Pipeline, which carries about 600,000 barrels of oil per day from tankers in the Pacific Ocean to the Caribbean Sea, thus bypassing the Panama Canal and the fees and tolls associated with the canal.

Information on rail and pipeline transport of mineral commodities within certain individual countries is provided in the appropriate country chapter.

PRICES

Comprehensive data on market prices for crude minerals and mineral products for the world as a whole do not exist, and even the data that are available and published are not comparable between countries, particularly between the market economy countries and the centrally planned economy countries. However, the regularly published prices for selected major commodities in key market areas can be regarded as indicative of general world price trends. Tables 12, 13, and 14 summarize prices for selected metals in the United States, the United Kingdom, and Canada, respectively, for 1983-1987, inclusive, with monthly data provided for 1987. Overall, the picture for these commodities was far brighter than in 1986; of 20 prices listed in the tables, 18 were at higher levels on average in 1987 than in 1986, with all of those showing increases that exceeded the U.S. inflation rate, most by very substantial margins. Of those listed, nickel (Canadian price) and cobalt (U.S. price) were the only metals that logged price drops. Moreover, although there were notable exceptions, the prices generally trended upward throughout the year. This was true perhaps most significantly for Canadian nickel. Although its 1987 average price was below that of 1986, it showed an increase in every month, and its average was low only because all listed prices in 1987 were substantially below the 1986 average. Other notable exceptions were the London gold price, which peaked in May, and the silver prices in the three markets, each of which peaked in April.

It is perhaps worthy of note that the data series for cobalt used for this chapter was changed from the Engineering and Mining Journal "Metals Week" price for shot/cathode in 250-kilogram lots to the average annual spot price for cathode, and which does not include monthly results. Two other metals for which annual average prices were readily available also showed advances between 1986 and 1987; the New York price for mercury advanced from $232.785 to $295.503 per 76-pound flask, and the major producers price for platinum rose from $514.147 to $600.00 per troy ounce. In contrast, the average New York price for antimony declined from 121.902 cents per pound to 110.581 cents per pound between 1986 and 1987.

Among the industrial minerals and their chemical derivatives, contract prices for export sulfur were significantly lower in the first half of 1987 than in the last half of 1986, and declined marginally in most cases in the second half of 1987, with measurable differences between the prices quoted for major export centers. In the U.S. gulf coast, f.o.b. prices that ranged between $130 and $136 per ton in the second half of 1986 fell to $95 to $107 per ton in the first half of 1987, and for the second half of 1987, the lower limit remained $95 per ton but the upper limit slipped to $100 per ton. Canadian prices, f.o.b. Vancouver, which were $125 to $135 per ton in the second half of 1986, declined to $98 to $110 per ton in the first half of 1987 and fell further to $90 to $100 in the second half of that year. The Middle East price, $120 per ton in the last half of 1986 (and as such the lowest sulfur price recorded), declined to $100 to $107 per ton for the first half of 1987, and further to $95 to $100 per ton for the second half of that year. In the case of Poland, the sulfur price f.o.b. Gdánsk was in the range of $135 to $145 per ton in the second half of 1986, declined to $110 to $113 per ton for the first half of 1987 and fell even further to $97 to $101 per ton for the second half of the year, leaving it the highest priced sulfur from a

major exporter, but only by a very small margin.

Urea export prices ranged from a low of about $65 per ton f.o.b. Eastern Europe in bulk to a high of $85 per ton f.o.b. Middle East ports for bagged product. The U.S. price on a bulk basis f.o.b. gulf ports was at about the same level as the Middle East product at the start of the year. The urea export price generally advanced across 1987, reaching a range of $90 per ton for the East European product to $115 per ton for the bagged Middle East product. Although there was a general upturn as indicated, prices for the Middle East product fell rather sharply between June and July. After holding level through August, they advanced again sharply in September, with a very slight increase thereafter through yearend.

In the case of ammonia, prices rose sharply from January to May, with the f.o.b. Caribbean price increasing from slightly below $90 per ton at the start of the year to $125 per ton by May 1, a level that was maintained for a month until a decline set in that bottomed at about $90 per ton at the start of October. This was followed by a very slight but steady increase to almost $95 per ton by yearend.

In contrast, potassic fertilizers enjoyed an uptrend in price across the year. Starting at $58-$59 per ton standard, f.o.b. Vancouver, in January, a level that held through March 1, potassium chloride at first registered small gains and then larger ones until a plateau of about $75 was reached on September 1. After 2 months of stability, a slight increase was logged between November and December, followed by another month of essentially unchanged price, with the yearend price at about $76.

Pricing patterns for phosphatic materials in 1987 were quite varied, but all registered higher levels at yearend. Triple superphosphate in bulk, f.o.b. U.S. gulf ports, started the year at about $113 per ton and ended the year at about $140 per ton. It reached a peak of $150 per ton in August, with a relatively steady downturn thereafter. Diammonium phosphate in bulk was priced at about $160 per ton f.o.b. U.S. gulf coast at the start of the year, and after an upturn through January, suffered reductions through February and March, bottoming at $150 per ton through the first of May, and then advancing to about $185 per ton on August 1. There followed a drop to $175 for the month of September, and then an upturn to a level of about $195 at yearend. The phosphoric acid price, expressed in terms of dollars per ton of contained P_2O_5, f.o.b. U.S. gulf ports, showed remarkably little change over the year, rising from about $230 to $250 during January and February, and holding at that level through the end of year except for a very small upturn in July and a balancing drop in September.

The pricing of energy materials on a global basis is so complex that the summary that follows can only touch on the broadest of generalities. The U.S. Department of Energy's compilation of average world crude oil prices shows an increase of 1.4% between January 1, 1987 and January 1, 1988, from $16.34 per barrel to $16.57 per barrel, but these global year-start-to-yearend results are a vast oversimplification of the actual events of the year. For example, breaking the world aggregate into two parts, one consisting of prices for OPEC and the other of prices for non-OPEC countries, the OPEC countries' average crude price advanced by nearly 4.2% across 1987, from $16.10 per barrel to $16.77 per barrel, whereas the average per-barrel price for non-OPEC countries dropped by 1.4% across 1987, from $16.44 to $16.21. These yearend-to-yearend comparisons, however, do not reflect substantial fluctuations across the year. For the non-OPEC countries, the average crude oil price advanced by 84 cents between January 1 and March 13, by an additional 73 cents between March 13 and May 29, and by an additional 89 cents between that date and August 7. Then a sharp drop set in that bottomed at $15.41 on December 18, with an 80 cent recovery by January 1, 1988. In contrast, the average OPEC price advanced by $1.25 between January 1 and March 13, 1987, increased by only 3 cents by May 29, and by only 20 cents more by August 7. Thereafter, it fell to $16.23 per barrel by December 18; it recovered 54 cents by January 1, 1988.

There were similar price declines evident in the case of petroleum refinery products, but to detail them would require far too much time and space in this summary. The most important effect of the restrained oil prices was that upon other energy products—coal and natural gas—and upon primary (hydroelectric and nuclear) electric-

ity generation. The availability of more-than-adequate liquid fuels at relatively low prices obviously restricted price increases for competitive fuels, to the detriment of energy producers, but on the other hand, the availability of energy commodities at noninflated prices was advantageous to nonfuel mineral producers and processors.

STATISTICAL SUMMARY OF WORLD PRODUCTION AND TRADE OF MAJOR MINERAL COMMODITIES

The final 24 tables of this chapter, tables 15-38, extend the statistical series on production that was started in the 1963 edition of the "Area Reports: International" volume of the "Minerals Yearbook" and was subsequently updated and expanded in the 1965 and 1967-86 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 1987 "Minerals Yearbook" and on a country basis in 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 the compilation of tables in the numerous commodity and country chapters 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 (volume I) have been included in many of the individual country production tables (volume III). 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, the tables of this chapter are sufficiently correct without the inclusion of these revisions.

The series of data on world trade in major mineral commodities that appeared in earlier editions of this chapter (tables 57-69 in the 1976 edition) could not be included owing to scheduling problems.

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[1]Senior Foreign Mineral Specialist, Division of International Minerals.

[2]Chief, Branch of Geographic Data, Division of International Minerals.

[3]Callot, F. Production et consommation mondiales de minerals en Annales des Mines. Nos. 7, 8, 9, July-Aug.-Sept. 1985, pp. 3-123.

[4]Table 1 contains 100 data lines, but 3 of these are totals of others; these total lines are not included in the total of 97 distinct commodities or forms of commodities counted here.

Table 2.—Value of world export trade in major mineral commodity groups[1]

(Million U.S. dollars)

Commodity group	1981	1982	1983[r]	1984[r]	1985[r]	1986
Metals:						
All ores, concentrates, scrap	28,187	24,481	23,247	25,448	24,863	24,112
Iron and steel	73,419	68,732	61,322	66,125	69,698	72,722
Nonferrous metals	36,279	31,967	36,575	36,185	34,536	36,172
Total	137,885	125,180	121,144	127,758	129,097	133,006
Nonmetals, crude only	10,956	9,938	9,325	9,857	9,952	10,540
Mineral fuels	474,266	430,384	384,188	378,406	362,158	263,738
Grand total	623,107	565,502	514,657	516,021	501,207	407,284
All commodities	1,965,890	1,848,930	1,812,944	1,909,324	1,931,217	2,117,895

[r]Revised.

[1]Data presented are for selected major commodity groups of the Standard International Trade Classification, Revision 2 (SITC-R2) and as such exclude some mineral commodities classified in that data array together with other (nonmineral) commodities. SITC-R2 categories included are as follows: All ores, concentrates, and scrap—Div. 28; iron and steel—Div. 67; nonferrous metals—Div. 68; nonmetals (crude only)—Div. 27; and mineral fuels—Div. 3. Major items not included are the metals, metalloids, and metal oxides of Group 513; mineral tar and other coal, petroleum, and gas-derived crude chemicals of Div. 52; manufactured fertilizers of Div. 56; and nonmetallic mineral manufactures of Groups 661, 662, 663, and 667. Data include special category exports, ship 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.

Sources: 1983-86 data: United Nations. Monthly Bulletin of Statistics. V. 42, May 1988, pp. 274-301; 1982 data: United Nations. Monthly Bulletin of Statistics. V. 41, No. 5, May 1987, pp. 274-301; 1981 data: United Nations. Monthly Bulletin of Statistics. V. 40, No. 5, May 1986, pp. xxxiv-1xi.

Table 3.—Distribution of value of world export trade in major mineral commodity groups[1]

(Percent)

Commodity group	1981	1982	1983[r]	1984[r]	1985[r]	1986
Metals:						
All ores, concentrates, scrap	4.5	4.3	4.5	5.0	5.0	5.9
Iron and steel	11.8	12.1	11.9	12.8	13.9	17.9
Nonferrous metals	5.8	5.7	7.1	7.0	6.9	8.9
Total	22.1	22.1	23.5	24.8	25.8	32.7
Nonmetals, crude only	1.8	1.8	1.8	1.9	2.0	2.6
Mineral fuels	76.1	76.1	74.6	73.3	72.2	64.7

[r]Revised.

[1]For detailed definition of groups, see footnote 1, table 2.

Table 4.—Growth of value of world export trade in major mineral commodity groups[1]

(Percent change from that of previous year)

Commodity group	1981[r]	1982	1983[r]	1984[r]	1985[r]	1986
Metals:						
All ores, concentrates, scrap	-11.3	-13.1	-5.0	+9.5	-2.3	-3.0
Iron and steel	-3.2	-6.4	-10.8	+7.8	+5.4	+4.3
Nonferrous metals	-27.2	-11.9	+14.4	-1.1	-4.6	+4.7
All metals	-12.4	-9.2	-3.2	+5.5	+1.0	+3.0
Nonmetals, crude only	-7.5	-9.3	-6.2	+5.7	+.9	+5.9
Mineral fuels	-1.4	-9.3	-10.7	-1.5	-4.3	-27.1
All major mineral commodity groups	-4.1	-9.2	-9.1	+.3	-2.9	-18.7
All commodities	-1.7	-5.9	-1.9	+5.3	+1.1	+9.7

[r]Revised.

[1]For detailed definition of groups, see footnote 1, table 2.

Table 5.—World consumption of selected mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1983[r]	1984[r]	1985[r]	1986	1987[p]
Ferrous metals: World:					
Iron ore, gross weight[e] million metric tons	770	830	855	[r]850	870
Iron and steel scrap, gross weight do	297	312	317	306	[e]314
Nonferrous metals:					
Market economy countries:					
Aluminum, refined	12,009	12,302	12,538	12,777	13,637
Cadmium	14	14	13	15	16
Copper, refined	6,842	7,660	7,366	7,716	8,034
Lead, refined	3,791	4,050	3,971	4,069	4,141
Magnesium, primary	179	194	192	188	210
Nickel[1]	486	582	569	572	638
Tin, refined	150	161	157	163	169
Zinc, slab	4,481	4,616	4,704	4,852	5,019
Centrally planned economy countries:					
Aluminum, refined	3,297	3,273	3,358	3,368	3,507
Cadmium	4	4	4	4	4
Copper, refined	2,262	2,269	2,354	2,369	2,384
Lead, refined	1,442	1,446	1,447	1,436	1,441
Magnesium, primary	88	94	102	105	108
Nickel[2]	201	200	206	206	210
Tin, refined	55	54	59	61	58
Zinc, slab	1,792	1,855	1,819	1,890	1,868
World total:					
Aluminum, refined	15,306	15,575	15,896	16,145	17,144
Cadmium	18	18	17	19	20
Copper, refined	9,104	9,929	9,720	10,085	10,418
Lead, refined	5,233	5,496	5,418	5,505	5,582
Magnesium, primary	267	288	294	293	318
Nickel[2]	687	782	775	778	848
Tin, refined	205	215	216	224	227
Zinc, slab	6,273	6,471	6,523	6,742	6,909
Industrial minerals: World:					
Fertilizers:					
Nitrogenous[3] million metric tons of contained N	61,079	67,184	70,587	70,338	72,032
Phosphatic[3] million metric tons of contained P_2O_5	30,631	32,718	34,158	33,301	[e]34,800
Potassic[3] million metric tons of K_2O equivalent	22,725	25,493	25,947	25,747	[e]27,000
Sulfur million metric tons of elemental sulfur equivalent	54,113	58,282	57,916	57,066	59,093
Mineral fuels: World:					
Solid fuels million metric tons of standard coal equivalent	2,762	2,877	3,029	3,083	[e]3,170
Liquid fuels do	3,607	3,661	3,631	3,701	[e]3,730
Natural gas do	1,861	1,973	2,055	2,093	[e]2,245
Hydro, geothermal, nuclear electricity do	360	395	427	445	[e]450
Total do	8,590	8,906	9,142	9,322	[e]9,595

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

[1]Primary and secondary combined.

[2]Nickel content of refined nickel, ferronickel, and nickel oxide.

[3]Data are for year ending June 30 of that stated.

Sources: Based on data provided by the World Bureau of Metal Statistics (market economy countries, nonferrous metals except magnesium); Metallgesellschaft AG (centrally planned economy countries, nonferrous metals and all magnesium consumption); British Sulphur Corp. Ltd. (nonmetals) except 1987 estimates; and 1986 United Nations Energy Statistics Yearbook (all mineral fuels for 1983-86). Data on iron ore and iron and steel scrap for all years and on fertilizers and mineral fuels for 1987 compiled from a variety of sources by the U.S. Bureau of Mines.

Table 6.—Annual investment expenditure in the steel industry for selected countries

(Million dollars)

Country or country group	1982	1983	1984	1985	1986
Organization for Economic Cooperation and Development (OECD):					
EEC[1]	2,427	2,103	1,965	r3,504	3,506
EFTA[2]	291	198	274	r372	401
Other:[3]					
Australia	217	64	96	r134	485
Canada	483	156	176	r310	476
Japan	3,720	3,744	2,669	r2,892	4,111
Spain[4]	204	131	290	r395	--
Turkey	58	232	217	210	146
United States	4,203	3,137	1,203	r1,641	863
Total[5]	11,603	9,765	6,890	r9,511	9,988
Latin America:					
Argentina	47	164	147	184	191
Brazil	1,056	1,248	809	472	413
Chile	3	2	11	1	4
Colombia	51	24	8	13	4
Ecuador	NA	NA	NA	2	NA
Mexico	387	410	526	491	119
Peru	14	5	1	4	2
Uruguay	17	9	1	1	1
Venezuela	89	90	25	25	121
Central America	6	6	(6)	NA	NA
Total[7]	1,670	[8]1,959	1,528	1,193	861
Grand total	13,273	11,724	8,418	r10,704	10,849

rRevised. NA Not available.

[1]Source reports that values for European Economic Community (EEC) countries are in terms of "million units of account." For this tabulation the units in the source have been converted to U.S. dollars using the following factors supplied by the International Monetary Fund: U.S. dollars per European units of account (ECU) at the end of the period: 1982—0.9677; 1983—0.8274; 1984—0.7089; 1985—0.8879; and 1986—1.0704.

[2]European Free Trade Association (EFTA) figures exclude data for Switzerland.

[3]Data for New Zealand have not been available since 1979.

[4]Spain and Portugal became members of the EEC effective Jan. 1, 1986.

[5]Sources for OECD: The Iron and Steel Industry in 1983. Paris, 1985, p. 32; The Iron and Steel Industry in 1984. Paris, 1986, p. 32; The Iron and Steel Industry in 1985. Paris, 1987, p. 32; and The Iron and Steel Industry in 1986. Paris, 1987, p. 32.

[6]Less than 1/2 unit.

[7]Source for Latin America: Instituto Latinamericano del Fierro y el Acero. Statistical Yearbook of Steelmaking and Iron Ore Mining in Latin America 1987. Santiago, p. 183.

[8]Data do not add to total shown because of rounding.

Table 7.—Market economy country petroleum industry capital and exploration expenditures, by geographical area

(Million dollars)

Area and type of expenditure	1982[r]	1983[r]	1984[r]	1985	1986
United States:					
Capital	6,730	4,400	3,710	3,710	2,800
Exploration	52,210	46,260	48,060	43,640	24,830
Total	58,940	50,660	51,770	47,350	27,630
Other North America:					
Capital	2,130	1,720	2,760	3,330	2,100
Exploration	6,610	6,810	9,490	8,790	6,380
Total	8,740	8,530	12,250	12,120	8,480
Central and South America:					
Capital	1,710	1,220	980	850	820
Exploration	8,930	6,920	4,750	4,910	4,870
Total	10,640	8,140	5,730	5,760	5,690
Western Europe:					
Capital	2,600	2,050	1,720	1,650	1,480
Exploration	11,890	11,960	12,100	11,620	11,550
Total	14,490	14,010	13,820	13,270	13,030
Africa and Middle East:					
Capital	2,230	1,880	1,750	990	940
Exploration	6,730	5,970	4,530	4,010	3,160
Total	8,960	7,850	6,280	5,000	4,100
Far East and Oceania:					
Capital	4,290	2,130	1,630	2,110	3,090
Exploration	5,040	5,240	4,970	4,400	3,680
Total	9,330	7,370	6,600	6,510	6,770
Tankers	4,270	4,300	2,050	990	1,580
World:					
Capital (including tankers)	23,960	17,700	14,600	13,630	12,810
Exploration	91,410	83,160	83,900	77,370	54,470
Grand total	115,370	100,860	98,500	91,000	67,280

Source: Chase Manhattan Bank, Global Energy Component. Capital Investments of the World Petroleum Industry 1985 and 1986. New York, Schedule 3.

Table 8.—Salient statistics on U.S. foreign investment in mineral industry activities

(Million dollars)

	1985[r]	1986[r]	1987
Direct foreign investment:			
Mining, smelting, refining	7,345	6,575	6,746
Petroleum	57,695	61,731	66,381
Reinvested earnings of foreign affiliates:			
Smelting and fabricated metals	198	446	875
Petroleum	2,594	470	2,933
Equity and intercompany account flows:			
Smelting and fabricated metals	-136	125	-656
Petroleum	-4,026	3,494	1,724
Income:			
Mining, smelting, refining	356	550	832
Petroleum	9,306	8,065	8,130

[r]Revised.

Source: U.S. Department of Commerce. Survey of Current Business, v. 68, No. 8, Aug. 1988.

Table 9.—World merchant fleet distribution, by type[1]

	1983	1984	1985	1986	1987
Number of vessels:					
Bulk carriers	5,384	5,560	5,787	5,481	5,302
Freighters[2]	14,268	14,019	13,937	12,786	12,572
Tankers	5,548	5,482	5,456	4,999	5,090
Other[3]	379	363	375	352	343
Total	25,579	25,424	25,555	23,618	23,307
Gross tonnage:					
Bulk carriers, thousand long tons	124,000	129,274	135,366	130,654	128,468
Freighters[2], do	94,222	94,549	97,284	93,157	93,966
Tankers, do	173,335	164,451	158,508	134,660	135,010
Other[3], do	3,768	3,705	3,898	3,798	3,688
Total, do	395,325	391,979	395,056	362,179	361,132
Deadweight tonnage:					
Bulk carriers, do	216,468	225,496	235,833	227,325	224,309
Freighters[2], do	125,646	124,758	126,542	118,845	116,937
Tankers, do	322,617	304,589	292,345	245,584	245,906
Other[3], do	1,673	1,579	1,604	1,476	1,405
Total, do	666,404	656,422	[4]656,323	[4]593,229	588,557

[1]Maritime Administration classification. Tankers include whaling tankers. Vessels shown here as "Other" include combination passenger and cargo and combination passenger and refrigerated cargo. Data are as of Dec. 31 of year indicated.
[2]Includes refrigerated freighters.
[3]Excludes refrigerated freighters.
[4]Data do not add to total shown because of independent rounding.

Source: U.S. Department of Transportation, Maritime Administration. Merchant Fleets of the World. Annual issues for 1983-86 and unpublished data supplied by the same agency 1987.

Table 10.—Movement of mineral commodities through the Panama Canal

(Thousand metric tons)

	1985			1986			1987		
	Atlantic to Pacific	Pacific to Atlantic	Total	Atlantic to Pacific	Pacific to Atlantic	Total	Atlantic to Pacific	Pacific to Atlantic	Total
METALS									
Ore and concentrate:									
Bauxite and alumina	231	1,163	1,394	103	898	1,001	116	744	860
Chromite	4	56	60	7	31	38	7	23	30
Copper	13	422	435	41	672	713	36	737	773
Iron	110	334	444	57	187	244	62	534	596
Lead	14	146	160	5	150	155	--	192	192
Manganese	103	173	276	47	195	242	36	193	229
Tin	1	25	26	--	30	30	--	15	15
Zinc	74	471	545	69	575	644	106	1,684	1,790
Other and unspecified	293	2,077	2,370	282	1,391	1,673	367	1,157	1,524
Subtotal	843	4,867	5,710	611	4,129	4,470	730	5,279	6,009
Ingots and semimanufactures:									
Aluminum	260	75	335	215	92	307	371	52	423
Copper	78	831	909	10	926	936	15	840	855
Iron and steel[1] [2]	5,260	5,186	10,446	6,076	4,272	10,348	5,859	3,733	9,592
Lead	5	98	103	5	82	87	3	51	54
Tin[1]	11	57	68	21	19	40	14	11	25
Zinc	37	159	196	47	176	223	14	152	166
Other	29	36	65	31	41	72	19	80	99
Subtotal	5,680	6,442	12,122	6,405	5,608	12,013	6,295	4,919	11,214
Total	6,523	11,309	17,832	7,016	9,737	16,753	7,025	10,198	17,223
INDUSTRIAL MINERALS									
Borax	--	421	421	1	406	407	3	385	388
Cement	259	5	264	196	23	219	253	3	256
Clays, fire and china	424	43	467	363	15	378	447	27	474
Fertilizer materials	9,683	2,368	12,051	7,694	2,414	10,108	10,047	2,148	12,195
Salt	78	532	610	103	760	863	120	1,128	1,248
Sulfur	16	3,100	3,116	24	3,419	3,443	8	3,278	3,286
Other[3]	209	236	445	199	21	220	185	39	224
Total	10,669	6,705	17,374	8,580	7,058	15,638	11,063	7,008	18,071
MINERAL FUELS									
Carbon black	29	5	34	22	1	23	6	85	91
Coal and coke	8,690	2,976	11,666	7,655	2,715	10,370	5,997	2,052	8,049
Petroleum:									
Crude	3,452	9,174	12,626	2,980	10,164	13,144	3,447	5,655	9,102
Refined	7,567	7,029	14,596	9,148	9,093	18,211	9,863	7,398	17,261
Subtotal	11,019	16,203	27,222	12,128	19,227	31,355	13,310	13,053	26,363
Total	19,738	19,184	38,922	19,805	21,943	41,748	19,313	15,190	34,503
Grand total	36,930	37,198	74,128	35,401	38,738	74,139	37,401	32,396	69,797

[1]Tinplate is included under "Tin" rather than under "Iron and steel" 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]Comprises asbestos, brick and tile, clinkers, diatomite, dross, marble and other stone, slag, and soda and other sodium compounds.

Source: Panama Canal Commission Annual Report 1987.

Table 11.—Movement of mineral commodities through the Suez Canal

(Thousand metric tons)

	1985			1986			1987		
	Northbound	Southbound	Total	Northbound	Southbound	Total	Northbound	Southbound	Total
METALS									
Aluminum ore (bauxite)	1,630	(1)	1,630	920	(1)	920	1,107	(1)	1,107
Chromium ore, concentrate, metal	168	(1)	168	49	(1)	49	73	(1)	73
Copper ore, concentrate, metal	309	(1)	309	335	(1)	335	117	(1)	117
Iron and steel:									
Iron ore	6,325	(1)	6,325	6,776	(1)	6,776	6,095	(1)	6,095
Scrap	4	2	6	61	--	61	--	--	--
Pig iron	(2)	1,216	1,216	(2)	1,128	1,128	(2)	1,877	1,877
Unwrought	(2)	2,576	2,576	(2)	1,671	1,671	(2)	2,161	2,161
Plates and sheets	(2)	1,125	1,125	(2)	1,002	1,002	(2)	770	770
Lead ore, concentrate, metal	367	(1)	367	268	(1)	268	221	(1)	221
Manganese ore, concentrate, metal	801	(1)	801	443	(1)	443	525	(1)	525
Tin ore, concentrate, metal	92	(1)	92	21	(1)	21	13	(1)	13
Titanium ore (ilmenite and rutile)	358	(1)	358	441	(1)	441	371	(1)	371
Tungsten[3]	--	(1)	(1)	18	(1)	18	24	(1)	24
Zinc ore, concentrate, metal	445	(1)	445	300	(1)	300	228	(1)	228
Other and unspecified:									
Ores	777	1,240	2,017	559	609	1,168	476	1,200	1,676
Metals	2,069	4,883	6,952	2,046	5,267	7,313	1,840	5,539	7,379
INDUSTRIAL MINERALS									
Cement	2	5,545	5,547	--	4,072	4,072	37	2,550	2,587
Fertilizer materials:									
Nitrogenous:									
Urea	(4)	3,388	3,388	(4)	3,077	3,077	(4)	4,145	4,145
Ammonium nitrate	(4)	214	214	(4)	196	196	(4)	91	91
Ammonium sulfate	(4)	187	187	(4)	423	423	(4)	82	82
Phosphatic	(4)	3,564	3,564	(4)	2,032	2,032	(4)	2,155	2,155
Potassic	(4)	1,663	1,663	(4)	1,223	1,223	(4)	1,423	1,423
Other and unspecified	2,959	3,831	6,790	3,245	2,526	5,771	3,578	4,223	7,801
Total	2,959	12,847	15,806	3,245	9,477	12,722	3,578	12,119	15,697
Salt	--	17	17	--	34	34	--	47	47
Minerals and rocks	707	601	1,308	792	414	1,206	690	559	1,249
MINERAL FUELS									
Coal and coke	8,172	264	8,436	6,584	490	7,074	11,597	335	11,932
Petroleum:									
Crude	54,782	4,125	58,907	65,386	3,169	68,555	48,756	2,863	51,619
Refinery products:									
Gasoline	1,397	565	1,962	1,710	1,085	2,795	2,095	1,248	3,343
Naphtha	2,187	161	2,348	2,841	489	3,330	4,307	232	4,539
Kerosene	131	2,932	3,063	368	3,111	3,479	166	1,338	1,504
Distillate fuel oil	4,348	1,938	6,286	5,022	2,225	7,247	4,431	3,541	7,972
Residual fuel oil	14,594	1,081	15,675	10,152	980	11,132	8,962	702	9,664
Lubricating oil	(5)	224	224	(5)	206	206	(5)	269	269
Petroleum residues	54	(5)	54	60	(5)	60	107	(5)	107
Other and unspecified	4,353	1,460	5,813	6,701	1,732	8,433	7,077	2,322	9,399
Total	107,031	42,802	149,833	115,098	37,161	152,259	102,893	39,672	142,565
All goods	151,901	105,695	257,596	165,048	97,404	262,452	152,951	103,984	246,935

[1]If any, included under "Other and unspecified: Ores."
[2]If any, included under "Other and unspecified: Metals."
[3]Reported simply as "Tungsten," but believed to consist mainly of tungsten concentrates with a small amount of metal included.
[4]If any, included under "Fertilizer materials: Other and unspecified."
[5]If any, included under "Petroleum: Other and unspecified."

Source: Suez Canal Authority Yearly Reports 1986 and 1987.

Table 12.—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]	Cadmium[7]	Cobalt[8]
1983	77.667	77.861	21.677	41.386	6.013	11.441	1.129	5.760
1984	81.000	66.757	25.548	48.601	5.680	8.140	1.693	10.40
1985	81.000	65.566	19.067	40.366	5.259	6.142	1.208	11.43
1986	55.869	64.652	22.047	37.995	2.941	5.470	1.248	7.49
1987:								
January	54.600	63.586	27.875	41.397	3.161	5.529	1.350	
February	59.447	64.125	26.038	38.379	3.160	5.488	1.350	
March	62.545	66.671	26.000	37.703	3.146	5.682	1.250	
April	64.966	65.729	27.845	38.187	3.171	7.428	1.255	
May	68.900	69.585	34.950	42.232	3.194	8.439	1.425	
June	72.545	72.946	36.932	45.048	3.136	7.411	1.875	NA
July	74.239	79.019	41.674	45.668	3.026	7.678	1.875	
August	81.667	80.783	42.000	44.430	3.117	7.847	1.941	
September	80.690	84.267	42.000	42.592	3.165	7.590	2.251	
October	84.393	87.453	42.000	41.745	3.182	7.562	2.785	
November	80.158	107.128	42.000	42.378	3.238	6.662	3.250	
December	83.386	131.915	42.000	43.311	3.177	6.790	3.250	
Average	72.295	81.096	35.943	41.923	3.156	7.009	1.988	6.56

NA Not available.

[1]For 1983-85 inclusive: U.S. list price, North American producer; for 1986-87: Metals Week U. S. market price.
[2]Electrolytic, f.o.b. refinery.
[3]Refined lead, 1983-Sept. 1986 inclusive: U.S. producer price; Oct. 1986-87; North America producer price.
[4]Prime Western, f.o.b. East St. Louis.
[5]U.S. dollars per pound, New York dealer.
[6]U.S. dollars per troy ounce, 0.999 fine, New York.
[7]U.S. dollars per pound, producer.
[8]U.S. dollars per pound, average annual spot for cathodes (new series).

Source: American Bureau of Metal Statistics Inc.

Table 13.—Nonferrous metal prices in the United Kingdom[1]

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

Year and month	Aluminum[2]	Copper[3]	Gold[4]	Lead[5]	Silver[6]	Tin[7]	Zinc[8]
1983	65.342	72.153	424.180	19.273	11.454	5.913	34.727
1984	56.526	62.562	360.438	20.117	8.140	5.566	40.459
1985	47.850	64.904	317.265	17.842	6.132	5.567	36.233
1986	52.179	62.314	367.512	18.429	5.465	2.723	34.194
1987:							
January	53.134	61.055	551.324	21.024	5.513	3.045	34.427
February	58.216	62.588	548.547	20.864	5.485	3.034	33.556
March	62.018	66.484	566.274	22.069	5.663	3.008	33.158
April	63.547	67.324	746.475	25.171	7.465	3.039	34.532
May	64.029	68.966	845.774	31.402	8.458	3.061	38.008
June	66.784	71.299	741.298	28.509	7.413	2.998	39.799
July	74.983	76.867	763.771	30.065	7.638	2.905	37.594
August	82.117	79.665	789.026	29.875	7.890	2.974	36.440
September	79.210	82.146	760.136	29.309	7.601	3.042	34.284
October	89.025	89.161	763.040	27.249	7.630	3.068	34.889
November	76.249	114.483	671.803	29.099	6.718	3.142	38.422
December	82.732	130.130	681.544	29.860	6.815	3.098	39.254
Average	71.004	80.847	702.418	27.041	7.024	3.035	36.197

[1]London Metal Exchange.
[2]Unalloyed ingot, 99.5%.
[3]For 1983 through June 1986, electrolytic wirebars, monthly average settlement price; for July 1986 through Dec. 1987, Grade A settlement price.
[4]U.S. dollars per troy ounce, final price.
[5]Refined lead, monthly average cash price.
[6]U.S. dollars per troy ounce, 0.999 fine, spot price.
[7]U.S. dollars per pound, Straits tin.
[8]Monthly average cash price: 1983—Aug. 1984 inclusive, slab; Sept. 1984—Dec. 1987, high grade.

Source: American Bureau of Metal Statistics Inc.

Table 14.—Nonferrous metal prices in Canada

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

Year and month	Copper[1]	Lead[2]	Nickel[3]	Silver[4]	Zinc[5]
1983	75.936	21.929	3.200	11.458	42.329
1984	63.365	25.805	3.200	8.140	49.006
1985	64.071	19.205	3.200	6.145	41.731
1986	64.222	22.246	3.200	5.474	40.403
1987:					
January	63.197	28.000	1.696	5.532	42.050
February	62.811	26.050	1.734	5.491	41.000
March	66.333	26.000	1.770	5.684	41.000
April	67.390	27.905	1.825	7.444	41.000
May	67.482	34.810	2.097	8.393	43.667
June	70.426	37.045	2.166	7.169	46.773
July	73.435	41.565	2.265	7.701	48.000
August	72.948	42.000	2.471	7.812	48.000
September	74.730	42.000	2.484	7.594	43.952
October	76.216	42.000	2.631	7.551	43.000
November	86.193	42.000	2.728	6.671	43.476
December	96.635	42.000	3.469	6.812	45.000
Average	73.150	35.948	2.277	6.988	43.910

[1]Hudson Bay Mining & Smelting Co. Ltd. delivered price for cathode.
[2]Producers' price, carload quantities, pig lead, Cominco Ltd.
[3]1983-86 inclusive: Canadian producer price. Beginning Jan. 1987: New York dealers, cathode.
[4]U.S. dollars per troy ounce.
[5]Producers' price, carload quantities, regular high grade, Cominco Ltd.

Source: American Bureau of Metal Statistics Inc.

Table 15.—Leading world producers of bauxite[1]

(Thousand metric tons, gross weight)

Country	1983	1984	1985	1986[p]	1987[e]
Australia	24,372	31,537	31,839	32,384	34,000
Guinea	12,421	13,160	13,100	12,130	13,400
Jamaica	7,683	8,937	5,975	6,944	[2]7,775
Brazil	7,199	6,433	5,846	6,544	7,250
U.S.S.R.[e 3]	6,185	6,185	6,185	6,185	6,190
Yugoslavia	3,500	3,347	3,538	3,459	[2]3,394
Hungary	2,917	2,994	2,815	3,022	[2]3,101
India	[r]1,976	[r]2,093	2,281	2,322	[2]2,685
Greece	2,455	2,296	2,453	2,230	2,400
China[e]	1,600	1,600	1,650	1,650	2,400
Guyana	1,087	1,333	[e]1,675	1,466	2,200
France	1,663	1,607	1,530	1,379	[2]1,271
Suriname	3,400	3,454	[e]3,000	3,847	1,200
Total	[r]76,458	[r]84,976	81,887	83,562	82,181
Other	[r]2,229	[r]2,823	2,609	2,531	8,121
Grand total	[r]78,687	[r]87,799	84,496	86,093	90,302

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available as of July 8, 1988.
[2]Reported figure.
[3]Includes bauxite equivalent of nepheline syenite concentrates and alunite ore (produced in the U.S.S.R. only).

Table 16.—Leading world producers of aluminum[1]

(Thousand metric tons)

Country	1983	1984	1985	1986[p]	1987[e]
United States	3,353	4,099	3,500	3,037	[2]3,343
U.S.S.R.[e]	2,000	2,100	2,200	2,300	2,400
Canada	1,091	1,227	1,282	1,364	1,530
Australia	478	758	851	882	[2]1,004
Brazil	401	455	549	758	840
Germany, Federal Republic of	743	777	745	765	730
Norway	713	765	712	712	[2]725
Venezuela	335	386	396	[e]424	427
China[e]	400	400	410	410	410
Spain	358	381	370	350	350
France	361	342	293	322	300
United Kingdom	[r]253	288	275	276	[2]297
Netherlands	235	249	251	266	280
India	204	269	260	257	250
Yugoslavia[e]	[2]258	[r]270	[r]280	[r]282	244
Italy	196	230	221	243	240
Romania	223	244	247	269	240
New Zealand	219	243	241	173	230
Indonesia	115	199	217	219	210
Total	[r]11,936	[r]13,682	13,300	13,309	14,050
Other	[r]1,968	[r]2,032	2,067	2,032	1,966
Grand total	[r]13,904	[r]15,714	15,367	15,341	16,016

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 3, 1988.
[2]Reported figure.

Table 17.—Leading world producers of chromite[1]

(Thousand metric tons, gross weight)

Country	1983	1984	1985	1986[p]	1987[e]
South Africa, Republic of	[r]2,466	3,407	3,699	3,907	3,789
U.S.S.R.[e]	2,940	2,940	2,940	[r]3,150	3,150
Albania[e]	685	720	825	850	830
Finland	245	446	506	678	710
Turkey	346	487	588	543	600
Zimbabwe	420	477	536	533	540
India	[r]360	423	560	616	520
Brazil	[r]161	[r]260	190	[r e]200	225
Philippines	267	261	272	[e]183	173
Total	[r]7,890	[r]9,421	10,116	10,660	10,537
Other	[r]321	[r]355	398	430	450
Grand total	[r]8,211	[r]9,776	10,514	11,090	10,987

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through May 6, 1988.

Table 18.—Leading world producers of mine copper[1]

(Thousand metric tons, Cu content of ore)

Country	1983	1984	1985	1986[p]	1987[e]
Chile[2]	[r]1,255	[r]1,308	1,360	1,299	1,418
United States[2]	1,038	1,103	1,106	1,147	[3]1,256
Canada[2]	653	[r]722	739	698	767
U.S.S.R.[e 2]	570	590	600	620	630
Zaire	537	562	558	[e]563	564
Zambia	541	533	459	462	470
Poland	402	431	431	434	437
Peru[2]	319	354	391	397	392
China[e]	175	180	185	185	300
Mexico	196	304	276	[e]285	300
Australia	[r]261	236	260	245	223
Papua New Guinea	202	[r]164	175	178	[3]218
Philippines	271	233	222	223	[3]215
South Africa, Republic of	205	198	195	184	[3]213
Total	[r]6,625	[r]6,918	6,957	7,020	7,403
Other	[r]1,034	1,081	1,123	1,105	1,072
Grand total	[r]7,659	[r]7,999	8,080	8,125	8,475

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through July 8, 1988.
[2]Recoverable.
[3]Reported figure.

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

(Thousand troy ounces)

Country	1983	1984	1985	1986[p]	1987[e]
South Africa, Republic of	21,847	21,861	21,565	20,514	[2]19,228
U.S.S.R.[e]	8,600	8,650	8,700	8,850	8,850
United States	2,003	2,085	2,427	3,739	[2]4,966
Canada	2,363	2,683	2,815	[e]3,365	3,788
Australia	984	1,296	1,881	2,414	3,472
Brazil[e]	[r]1,850	[r]1,900	[r]2,200	[r]2,300	2,300
China[e]	1,850	1,900	1,950	2,100	2,300
Philippines	817	827	1,063	1,296	1,071
Papua New Guinea	579	[e]835	1,187	1,128	[2]1,069
Colombia	[r]427	[r]731	1,142	1,286	[2]851
Chile	571	541	554	577	530
Zimbabwe	453	478	472	478	485
Total	[r]42,344	[r]43,787	45,956	48,047	48,910
Other	[r]2,819	[r]3,040	3,228	3,573	3,571
Grand total	[r]43,163	[r]46,827	49,184	51,620	52,481

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 10, 1988.
[2]Reported figure.

Table 20.—Leading world producers of iron ore, iron ore concentrates, and iron ore agglomerates[1]

(Thousand metric tons, gross weight)

Country	1983	1984	1985	1986[p]	1986[e]
U.S.S.R	245,200	247,104	247,639	249,959	251,000
Brazil	88,716	[r]112,132	128,251	132,288	131,600
Australia	71,038	[r]94,406	92,859	94,135	100,000
China[e]	71,000	75,000	80,000	90,000	100,000
India	[e]38,800	41,026	42,545	47,800	[2]52,000
United States	38,165	52,092	49,533	39,486	[2]47,568
Canada	33,495	41,065	39,502	36,167	37,550
South Africa, Republic of	16,605	24,647	24,414	24,483	21,998
Sweden	14,265	18,123	20,454	20,489	[2]19,627
Venezuela	9,715	13,054	16,228	19,125	17,780
Liberia	14,937	15,100	15,318	15,295	[2]13,742
France	15,930	14,839	14,447	12,436	[2]10,911
Mauritania	7,385	9,527	9,333	8,929	[2]9,000
Korea, North[e]	8,000	8,000	8,000	8,000	8,000
Mexico	8,040	8,317	7,820	7,298	7,522
Chile	[r]5,809	[r]6,685	6,534	6,981	6,690
Yugoslavia	5,018	5,321	5,478	6,618	5,983
Peru	4,287	3,979	4,892	5,036	4,850
Spain	7,449	7,261	6,463	6,089	3,800
Total	[r]703,854	[r]797,678	819,710	830,614	849,621
Other	[r]36,197	[r]38,152	38,301	37,778	33,477
Grand total	[r]740,051	[r]835,830	858,011	868,392	883,098

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through July 22, 1988.
[2]Reported figure.

Table 21.—Leading world producers of crude steel[1]

(Thousand metric tons)

Country	1983	1984	1985	1986[p]	1987[e]
U.S.S.R	152,514	154,238	154,668	160,550	162,000
Japan	97,179	105,586	105,279	98,275	[2]98,513
United States	76,762	83,940	80,067	74,032	[2]80,261
China	39,950	43,370	[e]46,700	[e]52,100	56,000
Germany, Federal Republic of	35,729	39,389	40,497	37,134	[2]36,248
Italy	21,674	24,026	23,744	22,872	22,900
Brazil	14,660	18,386	20,456	21,234	[2]22,231
France	17,623	19,000	18,832	17,624	[2]17,726
United Kingdom	14,986	15,121	15,722	14,811	[2]17,425
Poland	16,236	16,533	16,126	17,144	17,200
Korea, Republic of	11,915	13,033	13,539	14,554	[2]16,782
Czechoslovakia	15,024	14,831	15,036	[e]15,000	15,500
Canada	12,828	14,715	14,500	14,100	[2]14,700
Romania	12,593	14,437	13,795	[e]14,000	14,000
India	10,305	10,344	11,054	11,427	12,105
Spain	12,731	13,484	14,235	11,976	11,900
Belgium	10,157	11,303	10,683	9,744	9,600
South Africa, Republic of	7,190	7,827	8,582	[e]8,800	8,700
German Democratic Republic	7,219	7,573	7,853	7,967	8,200
Mexico	6,978	7,560	7,367	7,170	7,510
Total	594,253	634,696	638,735	630,514	649,501
Other	[r]68,722	75,549	77,985	79,828	79,999
Grand total	[r]662,975	710,245	716,630	710,342	729,500

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Steel ingots and castings. Table includes data available through July 1, 1988.
[2]Reported figure.

Table 22.—Leading world producers of mine lead[1]

(Thousand metric tons, Pb content of ore)

Country	1983	1984	1985	1986[p]	1987[e]
Australia	481	441	498	448	476
U.S.S.R.[e]	435	440	440	440	440
Canada	252	264	268	349	413
United States[2]	466	335	424	353	[3]319
China[e]	160	[r]180	[r]200	[3]227	[3]252
Peru	207	194	202	194	204
Mexico	184	203	198	207	200
Korea, North[e]	75	110	110	110	110
Yugoslavia	114	114	115	117	98
Total	2,374	[r]2,281	2,455	2,445	2,512
Other	[r]983	[r]981	973	931	942
Grand total	[r]3,357	[r]3,262	3,428	3,376	3,454

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 24, 1988.
[2]Recoverable.
[3]Reported figure.

Table 23.—Leading world producers of manganese ore[1]

(Thousand metric tons, gross weight)

Country	1983	1984	1985	1986[p]	1987[e]
U.S.S.R	9,876	10,089	9,900	9,300	9,300
South Africa, Republic of	2,886	3,049	3,601	3,719	2,892
Brazil	2,092	2,693	2,523	r e2,600	2,400
Gabon	1,857	2,119	2,340	2,510	2,400
Australia	1,370	1,849	2,003	1,649	2,1,853
China[e]	1,600	1,600	1,600	1,600	1,600
India	1,281	1,130	1,240	1,213	1,303
Mexico[e]	350	476	396	459	385
Ghana	173	269	316	340	295
Romania	78	66	66	e65	65
Hungary	59	67	63	63	64
Total	21,622	23,407	24,048	23,518	22,557
Other	284	r294	227	172	166
Grand total	21,906	r23,701	24,275	23,690	22,723

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 10, 1988.
[2]Reported figure.

Table 24.—Leading world producers of mine nickel[1]

(Thousand metric tons, Ni content)

Country	1983	1984	1985	1986[p]	1987[e]
Canada	128	174	170	164	188
U.S.S.R.[e]	170	175	180	r185	185
Australia	77	77	86	77	75
Indonesia	49	48	40	53	58
New Caledonia	46	58	r e72	r e62	56
Cuba	38	32	32	e33	34
South Africa, Republic of[e]	21	25	25	r32	34
China[e]	13	14	25	25	25
Total	542	603	630	631	655
Other	r132	r166	171	126	130
Grand total	r674	r769	801	757	785

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 24, 1988.

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

(Metric tons, Sn content of ore)

Country	1983	1984	1985	1986[p]	1987[e]
Malaysia	41,367	41,307	36,884	29,135	2,30,388
Brazil	13,275	19,957	26,514	25,200	2,28,900
Indonesia	26,553	23,223	21,759	24,049	2,27,000
U.S.S.R.[e]	22,000	23,000	23,000	23,500	24,000
Thailand	19,943	r21,960	16,864	17,066	2,15,006
China[e]	15,000	15,000	15,000	15,000	15,000
Australia	9,275	7,923	6,374	8,470	9,000
Bolivia	25,278	19,911	16,136	10,479	7,000
Peru	2,808	3,314	3,779	4,817	5,000
United Kingdom	4,025	5,216	5,204	4,276	4,000
Canada	141	217	120	e2,450	3,390
Zaire	2,163	2,708	3,100	e2,800	1,500
South Africa, Republic of	2,668	2,301	2,153	2,054	2,1,413
Total	184,496	r186,037	176,887	169,296	171,597
Other	r12,446	r12,426	11,748	10,081	8,116
Grand total	r196,942	r198,463	188,635	179,377	179,713

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 17, 1988.
[2]Reported figure.

Table 26.—Leading world producers of mine zinc[1]

(Thousand metric tons, Zn content of ore)

Country	1983	1984	1985	1986[p]	1987[e]
Canada	1,070	1,207	1,172	1,291	1,500
U.S.S.R.[e]	805	810	810	810	810
Australia	699	677	759	662	733
Peru	[r]492	[r]466	523	598	[2]592
China[e]	160	160	300	[2]396	425
Mexico	266	304	292	271	304
Spain	168	230	235	223	235
United States	297	278	252	216	[2]233
Korea, North[e]	140	140	180	180	225
Sweden	204	210	216	214	200
Poland	189	191	191	190	190
Ireland	186	206	192	182	[2]177
Japan	256	253	253	222	[2]166
Brazil	119	[r]114	124	124	119
South Africa, Republic of	110	106	97	102	[2]113
Germany, Federal Republic of	114	113	118	104	[2]102
Thailand	--	41	78	97	[2]89
Yugoslavia	87	[r]86	89	95	[2]81
Zaire	76	75	78	81	81
Greenland	79	71	70	62	[2]69
Total	[r]5,517	[r]5,738	6,029	6,120	6,444
Other	[r]766	[r]786	772	709	700
Grand total	[r]6,283	[r]6,524	6,801	6,829	7,144

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through July 15, 1988.
[2]Reported figure.

Table 27.—Leading world producers of hydraulic cement[1]

(Thousand metric tons)

Country	1983	1984	1985	1986[p]	1987[e]
China	108,250	121,080	[e]142,500	[e]161,560	180,000
U.S.S.R	128,156	129,866	130,722	135,119	136,000
United States (including Puerto Rico)	64,725	71,395	71,540	72,499	[2]72,122
Japan	80,891	78,860	72,857	71,246	70,000
India	25,356	29,030	33,050	36,400	[2]36,980
Italy	39,217	37,782	36,677	35,340	36,200
Korea, Republic of	21,282	20,413	20,424	23,403	[2]25,662
Brazil	20,870	19,741	20,612	25,297	[2]25,470
Germany, Federal Republic of	30,466	28,909	25,758	26,580	25,300
France	24,504	22,724	23,546	[e]23,500	[2]23,560
Spain (including Canary Islands)	30,637	25,435	24,197	[e]24,000	23,400
Turkey	13,595	15,738	17,581	20,004	[2]21,980
Mexico	17,068	[r]18,436	20,680	19,751	20,000
Poland	16,200	16,700	15,000	15,800	[2]16,100
Taiwan	14,810	14,234	14,418	14,806	[2]15,663
Romania	13,968	14,016	12,238	14,216	14,300
Greece	14,196	13,521	13,669	13,341	13,400
United Kingdom	13,396	13,481	13,339	[e]13,400	13,400
Iran[e]	10,000	[r]12,000	[r]12,400	[r]12,270	12,300
German Democratic Republic	11,782	11,555	11,608	11,908	11,500
Czechoslovakia	10,498	10,530	[e]10,265	[e]10,200	10,200
Total	709,867	[r]725,446	743,061	780,640	803,537
Other	[r]206,525	[r]213,624	215,530	219,040	229,871
Grand total	[r]916,392	[r]939,070	958,591	999,680	1,033,408

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through July 8, 1988.
[2]Reported figure.

Table 28.—Leading world producers of natural diamond[1]

(Thousand carats)

Country	1983	1984	1985	1986[p]	1987[e]
Australia	6,200	5,692	7,070	29,211	[2]30,333
Zaire	11,982	18,459	20,159	23,304	23,350
Botswana	10,731	12,914	12,635	13,110	[2]13,207
U.S.S.R.[e]	10,700	10,700	10,800	10,800	12,000
South Africa, Republic of	10,311	10,143	10,202	10,228	[2]9,053
Namibia	963	930	910	1,010	[2]1,020
China[e]	1,000	1,000	1,000	1,000	1,000
Ghana	340	346	632	560	600
Total	52,227	60,184	63,408	89,223	90,563
Other	3,165	[r]3,268	2,606	2,533	2,466
Grand total	55,392	[r]63,452	66,014	91,756	93,029

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Gem and industrial grades undifferentiated. Table includes data available through June 3, 1988.
[2]Reported figure.

Table 29.—Leading world producers of nitrogen in ammonia[1]

(Thousand metric tons, N content)

Country	1983	1984	1985	1986[p]	1987[e]
U.S.S.R	16,900	17,700	18,200	19,600	20,000
China[e]	13,776	14,000	15,000	15,500	14,500
United States	10,248	12,127	12,009	10,432	[2]12,051
India[3]	3,565	3,975	4,324	5,410	5,300
Netherlands	1,744	2,312	2,386	2,153	2,828
Romania	2,727	2,861	2,880	[e]2,900	2,800
Canada	2,888	3,493	3,620	[r e]3,540	2,742
Indonesia	1,150	1,658	2,057	2,299	2,364
France	[r e]1,960	[r e]2,350	2,012	2,022	[2]2,029
Germany, Federal Republic of	1,703	1,963	1,908	1,570	1,931
Poland	1,425	1,494	[e]1,254	[e]1,250	1,831
Mexico	1,936	1,773	1,859	1,602	1,814
Japan	1,545	1,668	1,628	1,476	1,556
Italy	1,060	1,210	1,460	1,510	[2]1,432
United Kingdom	1,720	1,836	1,767	1,388	[2]1,415
German Democratic Republic	1,206	1,203	1,206	1,193	1,250
Pakistan	1,098	1,128	1,107	1,154	1,180
Bulgaria	1,123	1,138	1,138	[e]1,140	1,145
Trinidad and Tobago	993	1,080	1,086	[e]1,100	1,127
Total	[r]68,767	[r]74,969	76,901	77,239	79,295
Other	[r]11,615	[r]12,988	12,645	12,909	13,709
Grand total	[r]80,382	[r]87,957	89,546	90,148	93,004

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through May 20, 1988.
[2]Reported figure.
[3]Data are for year beginning Apr. 1 of that stated.

Table 30.—Leading world producers of phosphate rock[1]

(Thousand metric tons, gross weight)

Country	1983	1984	1985	1986[p]	1987[e]
United States	42,573	49,197	50,835	38,710	[2]40,954
U.S.S.R.[e]	[r]33,100	[r]33,300	[r]33,750	[r]33,900	34,100
Morocco[3]	20,106	21,245	20,737	21,178	20,955
China[e]	12,500	11,800	6,970	6,700	9,000
Jordan	4,749	6,263	6,067	6,249	6,801
Tunisia	5,924	5,346	4,530	5,951	6,390
Brazil	3,208	3,855	4,214	4,509	4,777
Israel	2,969	3,312	4,076	3,673	[2]3,798
Togo	2,081	2,696	2,452	2,314	[2]2,644
South Africa, Republic of	2,887	2,585	2,433	2,920	2,623
Total	[r]130,097	[r]139,599	136,064	126,104	132,042
Other	[r]10,792	[r]11,969	12,542	12,636	13,106
Grand total	[r]140,889	[r]151,568	148,606	138,740	145,148

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

[1]Includes only phosphate rock; Thomas slag and guano are excluded. Table includes data available through May 13, 1988.

[2]Reported figure.

[3]Includes output from Western Sahara.

Table 31.—Leading world producers of marketable potash[1]

(Thousand metric tons, K_2O equivalent)

Country	1983	1984	1985	1986[p]	1987[e]
U.S.S.R.	9,294	9,776	10,367	10,200	10,400
Canada	6,938	7,527	6,661	6,752	7,465
German Democratic Republic	3,431	3,465	3,465	3,485	3,500
Germany, Federal Republic of	2,419	2,645	2,583	2,165	2,140
France	1,536	1,739	1,750	1,617	1,650
Israel	1,000	1,100	1,200	1,255	1,300
United States	1,429	1,564	1,296	1,202	[2]1,202
Total	26,047	27,816	27,322	26,672	27,657
Other	1,371	1,518	1,829	2,086	2,155
Grand total	27,418	29,334	29,151	28,758	29,812

[e]Estimated. [p]Preliminary.

[1]Table includes data available through Apr. 29, 1988.

[2]Reported figure.

Table 32.—Leading world producers of salt[1]

(Thousand metric tons)

Country	1983	1984	1985	1986[p]	1987[e]
United States (including Puerto Rico)	31,393	35,612	35,441	33,296	[2]33,142
China[e]	16,130	[r]16,286	14,446	17,300	18,000
U.S.S.R.	16,200	16,500	16,100	[e]16,100	16,100
Germany, Federal Republic of	10,868	12,212	13,080	13,102	13,200
India	7,013	7,728	9,879	10,118	11,002
Canada	8,602	10,235	10,085	10,332	9,990
France	6,949	7,149	7,113	7,084	7,161
United Kingdom	6,311	7,126	7,145	[r e]7,000	7,000
Australia	5,170	5,695	[e]6,200	[e]6,200	[e]6,200
Poland	[e]3,630	4,441	4,865	5,421	[2]6,168
Mexico	5,703	6,167	6,467	5,927	6,000
Romania	4,596	4,874	5,019	5,355	5,400
Netherlands	3,124	3,674	4,154	3,763	[2]3,979
Italy	4,189	3,978	3,746	[e]4,030	3,880
Brazil	[3]4,187	4,527	2,729	[r e]3,500	3,500
German Democratic Republic	[e]3,126	[e]3,133	3,138	3,134	3,133
Spain	3,158	3,389	3,240	[e]3,100	3,100
Japan	921	955	[e]1,200	1,370	[2]1,397
Turkey	1,261	1,290	1,189	1,172	[3]1,218
Total	[r]142,531	[r]154,971	155,236	157,304	159,570
Other	[r]16,313	[r]17,187	17,795	19,271	23,053
Grand total	[r]158,844	[r]172,158	173,031	176,580	182,623

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through July 8, 1988.
[2]Reported figure.
[3]Sales.

Table 33.—Leading world producers of elemental sulfur[1]

(Thousand metric tons)

Country	1984				1985			
	Native	From pyrites	Byproduct	Total	Native	From pyrites	Byproduct	Total
United States	[2]4,193	W	6,459	10,652	[2]5,011	W	6,598	11,609
U.S.S.R.[e]	[3]2,600	[r]2,600	[r]4,000	[r]9,200	[r 3]2,650	[r]2,500	[r]4,124	[r]9,274
Canada	--	(4)	6,596	[r]6,596	--	(4)	6,684	6,684
Poland[e]	[3]4,990	--	220	5,210	[3]4,876	--	220	5,096
China[e]	200	2,100	350	2,650	300	2,200	400	2,900
Mexico	[2]1,364	--	[e]621	[e]1,985	[2]1,551	--	[e]629	[e]2,180
Japan	--	259	2,333	2,592	--	253	2,245	2,498
Germany, Federal Republic of[e]	--	--	1,481	1,481	--	--	1,569	1,569
Saudi Arabia	--	--	833	833	--	--	1,100	1,100
France	--	--	1,862	1,862	--	--	1,723	1,723
Spain	--	1,094	[e]137	[e]1,231	--	1,231	[e]124	[e]1,355
Iraq[e]	[2]500	--	70	570	[2]500	--	70	570
South Africa, Republic of	--	464	[e]121	585	--	562	[e]185	[e]747
Finland	--	211	310	521	--	248	302	550
Yugoslavia	--	301	[e]163	[e]464	--	323	[e]173	[e]496
Italy	8	192	[e]200	[e]400	1	280	[e]200	[e]481
Australia	--	--	203	203	--	--	447	447
Sweden	--	[r]212	148	360	--	210	146	356
Iran[e]	30	--	130	160	30	--	150	180
German Democratic Republic[e]	--	--	350	350	--	--	330	330
Philippines	--	[r]39	95	[r]134	--	108	100	208
Brazil	[2]4	89	123	216	[2]4	91	134	229
Romania	--	200	150	350	--	200	150	350
Norway	--	[r]203	70	273	--	193	70	263
Belgium[e]	--	--	240	240	--	--	250	250
Netherlands[e]	--	--	245	245	--	--	250	250
Korea, North[e]	--	200	30	230	--	200	30	230
Greece	--	78	[e]125	[e]203	--	[e]78	[e]135	[e]213
United Kingdom	--	--	[r]146	[r]146	--	--	149	149
Total	[r]13,889	[r]8,242	[r]27,811	[r]49,942	14,923	8,677	28,687	52,287
Other	149	483	1,285	1,917	182	514	1,348	2,044
Grand total	[r]14,038	[r]8,725	[r]29,096	[r]51,859	15,105	9,191	30,035	54,331

See footnotes at end of table.

Table 33.—Leading world producers of elemental sulfur[1]—Continued

(Thousand metric tons)

Country	1986[p]				1987[e]			
	Native	From pyrites	Byproduct	Total	Native	From pyrites	Byproduct	Total
United States	[2]4,043	W	7,044	11,087	[2] [5]3,202	W	[5]7,336	[5]10,538
U.S.S.R.[e]	[r] [3]2,775	[r]2,350	[r]4,150	[r]9,275	[3]2,850	2,300	4,400	9,550
Canada	--	([4])	6,543	6,543	--	--	[5]6,668	[5]6,668
Poland[e]	[3]4,900	--	220	5,120	[3]5,000	--	220	5,220
China[e]	300	2,500	300	3,100	300	2,500	300	3,100
Mexico	[2]1,588	--	[r e]632	[r e]2,220	[2] [5]1,806	--	[5]593	[5]2,399
Japan	--	158	2,213	2,371	--	79	2,142	2,221
Germany, Federal Republic of[e]	--	--	[r]1,573	[r]1,573	--	--	1,625	1,625
Saudi Arabia	--	--	[e]1,300	[e]1,300	--	--	1,400	1,400
France	--	--	[e]1,306	[e]1,306	--	--	1,252	1,252
Spain	--	1,195	[e]115	[e]1,310	--	1,000	120	1,120
Iraq[e]	[2]600	--	[r]200	[r]800	620	--	250	870
South Africa, Republic of	--	499	218	717	--	500	220	720
Finland	--	275	[r e]302	[r e]577	--	[5]311	260	571
Yugoslavia	--	344	[r e]178	[r e]522	--	[5]323	178	501
Italy	--	309	[e]185	[e]494	--	300	190	490
Australia	--	--	443	443	--	--	444	444
Sweden	--	227	174	401	--	220	175	395
Iran[e]	30	--	[r]250	[r]280	30	--	300	330
German Democratic Republic[e]	--	--	315	315	--	--	315	315
Philippines	--	113	[e]120	[r e]233	--	[5]158	140	298
Brazil	[2]6	92	174	272	[2]6	92	190	288
Romania	--	150	140	290	--	150	130	280
Norway	--	181	[r e]80	[r e]261	--	170	95	265
Belgium[e]	--	--	260	260	--	--	250	250
Netherlands[e]	--	--	250	250	--	--	245	245
Korea, North[e]	--	200	30	230	--	200	30	230
Greece	--	[r e]66	[e]135	[r e]201	--	70	135	205
United Kingdom	--	--	175	175	--	--	174	174
Total	14,242	8,659	29,025	51,926	13,814	8,373	29,777	51,964
Other	154	527	1,467	2,148	164	527	1,566	2,257
Grand total	14,396	9,186	30,492	54,074	13,978	8,900	31,343	54,221

[e]Estimated. [p]Preliminary. [r]Revised. W Withheld to avoid disclosing company proprietary data.

[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 3, 1988.

[2]Entirely Frasch process sulfur.

[3]Includes Frasch process sulfur as follows, in thousand metric tons: Poland (estimated): 1984—4,500, 1985—4,386, 1986—4,400, and 1987—4,500; the U.S.S.R. (estimated): 1984—800, 1985—850, 1986—875, and 1987—950; and total of individually listed countries and grand total: 1984—11,361 (revised), 1985—12,302, 1986—11,512, and 1987—11,084.

[4]Revised to zero.

[5]Reported figure.

Table 34.—Leading world producers of coal (all grades)[1]

(Million metric tons)

Country	1984			1985			1986[p]			1987[e]		
	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total
China[e]	(2)	772	772	(2)	850	850	(2)	870	870	(2)	920	920
United States	57	756	813	66	736	802	69	738	808	[3]71	[3]762	[3]833
U.S.S.R	156	557	713	157	569	726	163	588	751	165	595	760
German Democratic Republic	296	--	296	312	--	312	311	--	311	[3]309	--	[3]309
Poland	50	192	242	58	192	250	67	192	259	[3]73	[3]193	[3]266
Australia	35	139	174	37	158	195	38	170	208	45	179	224
India	8	146	154	8	149	157	8	163	171	[3]8	[3]177	[3]186
Germany, Federal Republic of	127	79	206	121	82	203	114	81	195	[3]109	[3]76	[3]185
South Africa, Republic of	--	163	163	--	174	174	--	177	177	--	[3]177	[3]177
Czechoslovakia	103	26	129	102	26	129	103	26	129	103	26	129
United Kingdom	(4)	r51	r51	(4)	94	94	(4)	112	112	(4)	107	107
Yugoslavia	65	(4)	65	69	(4)	70	70	(4)	70	[3]72	([3 4])	[3]72
Korea, North[e]	r12	r44	r56	r15	r55	r70	r15	r55	r70	15	55	70
Canada	10	48	58	10	60	70	8	58	66	9	60	69
Turkey	27	7	34	36	9	45	36	9	45	[3]46	[3]8	[3]54
Romania	36	8	44	38	9	47	39	9	48	39	9	48
Greece	32	--	32	36	--	36	38	--	38	[3]43	--	[3]43
Bulgaria	32	(4)	32	31	(4)	31	35	(4)	35	38	(4)	38
Spain	24	15	39	24	16	40	22	16	38	[3]21	[3]14	[3]35
Korea, Republic of	--	21	21	--	25	25	--	24	24	--	[3]24	[3]24
Hungary	22	3	25	21	3	24	21	2	23	[3]21	[3]2	[3]23
Total	r1,092	r3,027	r4,119	1,141	3,207	4,350	1,157	3,290	4,448	1,187	3,384	4,572
Other	16	90	106	16	93	112	23	95	118	25	100	125
Grand total	r1,108	r3,117	r4,225	1,157	3,300	4,457	1,180	3,385	4,565	1,212	3,484	4,696

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

[1]Table includes data available through Oct. 31, 1988. Data may not add to totals shown because of independent rounding.

[2]Output small; included under "Bituminous and anthracite."

[3]Reported figure.

[4]Less than 1/2 unit.

Table 35.—Leading world producers of marketed natural gas[1]

(Billion cubic feet)

Country	1983	1983	1985	1986[p]	1987[e]
U.S.S.R	18,900	20,700	22,700	24,200	25,700
United States	16,033	17,392	16,382	15,991	[2]16,536
Canada	2,465	2,506	2,831	2,696	[2]2,803
Netherlands	2,703	2,728	2,851	2,615	[2]2,622
United Kingdom	1,367	1,361	1,517	1,594	[2]1,682
Algeria	1,427	1,545	1,320	1,360	1,525
Mexico	[r]1,319	[r]1,243	1,197	1,175	[2]1,194
Indonesia	1,032	1,386	1,449	1,113	1,188
Romania[e]	1,100	1,127	1,126	1,120	1,120
Norway	932	964	983	973	[2]1,076
Saudi Arabia	155	253	716	848	710
Iran	327	494	661	557	[2]596
Italy	459	489	503	564	[2]576
Germany, Federal Republic of	622	563	511	490	[2]560
Australia	420	446	475	519	[2]531
Argentina	464	[r]499	503	517	[2]506
United Arab Emirates	120	430	499	[e]492	500
China	431	438	455	485	495
Venezuela	508	518	498	576	465
German Democratic Republic	353	459	459	459	459
Malaysia (Sarawak)	131	325	437	372	410
Total	[r]51,268	[r]55,866	57,773	58,716	61,254
Other	3,773	4,153	4,249	4,760	6,820
Grand total	[r]55,041	[r]60,019	62,022	63,476	68,074

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

[1]Comprises all gas collected and utilized as a fuel or 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 to the atmosphere, flared, and/or reinjected to reservoirs. Table includes data available through Oct. 31, 1988.

[2]Reported figure.

Table 36.—Leading world producers of natural gas liquids[1]

(Million 42-gallon barrels)

Country[2]	1983	1984	1985	1986[p]	1987[e]
United States	569	597	587	566	[3]582
U.S.S.R.[e]	155	160	175	180	185
Algeria	92	119	122	[e]122	125
Mexico	105	136	[e]123	118	123
Saudi Arabia	119	124	123	150	[3]119
Canada	114	139	125	120	117
United Kingdom	47	55	60	68	67
United Arab Emirates (Abu Dhabi, Dubai, Ras al-Khaimah)[e]	[3]92	94	78	80	49
Total	1,293	1,424	1,391	1,404	1,367
Other	146	202	221	234	243
Grand total	1,439	1,626	1,612	1,638	1,610

[e]Estimated. [p]Preliminary.

[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 Oct. 31, 1988.

[2]In addition to the countries listed, China, Czechoslovakia, and the German Democratic Republic may also produce natural gas liquids in substantial quantities, but available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

Table 37.—Leading world producers of crude oil[1]

(Million 42-gallon barrels)

Country	1983	1984	1985	1986[p]	1987[e]
U.S.S.R	4,530	4,500	4,380	4,520	4,590
United States	3,171	3,250	3,274	3,168	[2]3,047
Saudi Arabia[3]	1,657	1,702	1,237	1,841	[2]1,536
China	774	836	874	954	978
Mexico	973	983	960	886	[2]927
United Kingdom	809	885	894	884	[2]858
Iran	891	794	803	686	854
Iraq	401	438	521	617	765
Venezuela	657	[r]660	614	654	[2]664
Canada	495	526	538	537	[2]561
United Arab Emirates (Abu Dhabi, Dubai, Sharjah)	420	391	439	500	[2]548
Indonesia	490	517	484	507	509
Kuwait[3]	385	424	374	519	[2]497
Nigeria	452	508	544	534	[2]487
Libya	[r]405	[r]406	392	389	368
Total	[r]16,509	[r]16,820	16,328	17,196	17,189
Other	[r]2,824	[r]3,020	3,253	3,204	3,286
Grand total	[r]19,333	[r]19,838	19,581	20,400	20,475

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through Oct. 31, 1988.
[2]Reported figure.
[3]Includes the country's share of production from the Kuwait-Saudi Arabia Divided Zone.

Table 38.—Leading world producers of refined oil[1]

(Million 42-gallon barrels)

Country	1983	1984	1985	1986[p]	1987[e]
United States (including Puerto Rico and Virgin Islands)	4,998	5,223	5,179	5,448	[2]5,505
U.S.S.R.[e]	[r]3,560	[r]3,525	[r]3,430	[r]3,530	3,585
Japan	1,308	1,399	1,304	[e]1,272	1,237
China[e]	500	550	655	700	710
United Kingdom	600	618	610	621	632
Germany, Federal Republic of	687	683	665	649	622
Italy	649	629	595	[e]597	600
France	564	570	603	584	586
Canada	549	560	569	565	561
Mexico	467	502	519	557	520
Brazil	[e]395	[e]405	450	496	453
Netherlands	402	407	364	430	[2]436
Venezuela	323	325	379	391	369
Saudi Arabia[3]	314	[r]395	382	[e]363	358
India	263	252	306	335	357
Spain (including Canary Islands)	337	327	351	364	350
Singapore	306	293	[e]294	[e]287	282
Total	[r]16,222	[r]16,663	16,655	17,189	17,163
Other	[r]4,418	[r]5,749	4,855	4,849	5,078
Grand total	[r]20,640	[r]22,412	21,510	22,038	22,241

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through Oct. 31, 1988.
[2]Reported figure.
[3]Includes the country's share of production from the Kuwait-Saudi Arabia Divided Zone.

The Mineral Industry of Albania

By Walter G. Steblez[1]

Albania's centrally planned economy and mineral industry lost ground in 1987. Compared with that of 1986, the economy stagnated, and several sectors performed below the output levels reached in 1984 and 1985. In contrast with previous years, Albania's Central Statistical Directorate did not publish national income or industrial production results in the central economic plan fulfillment report for 1987. Other national accounting indices were left out as well.[2] Reportedly, only coal, copper, and nickeliferous iron ore met planned production goals for 1987. The chromite and petroleum extracting and processing industries, two mainstays of the country's economy and chief earners of foreign exchange, fell substantially short of meeting planned output goals for 1987. Shortfalls were attributed to a prolonged summer drought and a harsh winter as well as to managerial problems.[3] Major capital projects during the year included the addition of new capacities at the Burrel ferrochromium plant and the construction of new facilities at the Bulquizë, Kalimash 1, and Kalimash 2 chromite mines.

Government Policies and Programs.—In 1987, the Albanian Government sought to widen diplomatic and economic contacts with several Western European countries and to end self-imposed political and economic isolation in Europe. Among the chief reasons for this policy change was the prospect of expanding barter-based commercial agreements with countries like the Federal Republic of Germany, Greece, and France to develop domestic mineral deposits and to increase output from existing operations through infusions of new technology and know-how. Albania remained a relatively poor country with an outdated industrial base. To maintain hard-currency earnings, Albania had to increase the production and sales of chromite and petroleum. The mining and extraction of these commodities had become more difficult owing to increasing depths of extraction in the case of chromite and the need for deep drilling and recovery equipment for the petroleum industry. Albania hoped to obtain advanced technology and equipment from Western market economy countries to maintain and increase production levels. The Government plan for 1988 called for an 18% increase in the output of petroleum compared with that of 1987. The production of chromite, copper, and nickeliferous iron ore was to increase 12%, 4%, and 18%, respectively. In 1988, the Government planned to initiate the marketing of barite, fluorite, and refractory clays. The 1988 plan also called for a 6% rise in the production of blister copper and a 17% increase in the output of ferrochromium.

PRODUCTION

The mineral industry of Albania was only partially mechanized and very labor intensive. The industry was state-owned and -operated and subject to strict central planning. The use of gross-output indicators often resulted in low-quality production at a high cost, owing to the management practice of stressing production in gross tons of output rather than output that could be usefully consumed. As in previous years, this led to a situation that allowed simultaneous stockpiling and shortages. Shortages of spare parts led to extensive downtimes of mining and transport equipment.

Table 1.—Albania: Estimated production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987
Asphalt and bitumen, natural[3] thousand tons	1,000	900	900	950	950
Cement, hydraulic do.	840	840	850	850	860
Chromium:					
Chromite, gross weight do.	914	[4]960	[4]1,100	1,200	1,200
Marketable ore do.	685	720	825	850	830
Coal: Lignite do.	1,779	[4]2,010	2,195	2,200	2,100
Cobalt, mine output, Co content[5]	450	600	600	650	650
Copper:					
Ore:					
Gross weight	891,000	[4]1,007,000	1,010,000	1,100,000	1,100,000
Cu content	14,300	16,100	16,200	17,600	17,800
Metal, primary:					
Smelter	11,000	[4]12,600	12,600	13,700	14,000
Refined	10,500	11,500	11,500	11,700	12,000
Gas, natural, gross production[6] million cubic feet	14,000	17,500	13,500	16,000	16,000
Iron and steel:					
Iron ore, nickeliferous:					
Gross weight	850,000	[4]1,082,000	1,130,000	1,200,000	1,200,000
Iron content	283,000	360,000	376,000	400,000	400,000
Ferroalloys, ferrochromium	35,000	40,000	43,000	45,000	46,000
Nickel, mine output, Ni content	7,200	9,200	9,600	9,700	9,000
Nitrogen: N content of ammonia	76,000	80,000	80,000	80,000	80,000
Petroleum:					
Crude:					
Weight thousand tons	1,500	1,400	1,400	1,500	1,500
Converted thousand 42-gallon barrels	9,900	9,800	9,800	9,900	9,900
Refinery products	9,000	9,000	9,000	9,000	9,000
Salt	70,000	70,000	70,000	70,000	75,000
Sodium compounds, n.e.s.: Carbonate, calcined (soda ash)	25,000	25,000	31,000	33,000	31,000

[1]Table includes data available through July 1988.

[2]In addition to the commodities listed, a variety of industrial minerals and crude construction materials (bauxite, common clay, dolomite, quartz, olivinite, sand and gravel, stone, and titanomagnetite) are 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]Reported figure.

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

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

TRADE

In 1987, Albania renewed its commercial and trade agreements for 1988 with centrally planned economy countries. As in past years, Bulgaria, Czechoslovakia, the German Democratic Republic, Hungary, Romania, and Yugoslavia would provide Albania with a variety of needed capital goods and semimanufactures in exchange for mineral raw materials and commodities, principally bitumen, chromite, and nickeliferous iron ore. At yearend, during discussions that led to the establishment of diplomatic relations with the Federal Republic of Germany, Albania indicated interest in reaching commercial agreements that would involve the Federal Republic of Germany in the modernization of Albania's agriculture and in Albania's mineral exploration plan, especially for bromine, copper, and nickel. Albania also expressed interest in upgrading its mineral transportation infrastructure with the aid of the Federal Republic of Germany. The United States remained an exporter of metallurgical coal to Albania. Because of a lack of diplomatic ties, trade between the United States and Albania was conducted through third parties.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal destinations, 1986
METALS			
Aluminum:			
Ore and concentrate	--	11,903	All to Poland.
Metal including alloys, semimanufactures	55	--	
Chromium: Ore and concentrate	586,199	384,971	Yugoslavia 152,114; Italy 63,840; Spain 43,419.
Copper:			
Matte and speiss including cement copper	--	474	All to Greece.
Ash and residue containing copper	--	2,974	All to Italy.
Metal including alloys:			
Scrap	279	--	
Semimanufactures	278	847	West Germany 499; Yugoslavia 348.
Iron and steel: Metal:			
Ferroalloys:			
Ferrochromium	3,750	36,790	Netherlands 15,343; West Germany 9,477; Belgium-Luxembourg 5,934.
Unspecified	4,798	2,600	West Germany 1,746; France 604; Austria 250.
Semimanufactures:			
Bars, rods, angles, shapes, sections	--	66	All to Italy.
Tubes, pipes, fittings do	1,017	--	
Lead: Metal including alloys, unwrought	--	12	All to Greece.
Nickel:			
Ore and concentrate	--	2,896	Do.
Matte and speiss	489	392	All to Japan.
Oxides and hydroxides	--	10	All to Netherlands.
Ash and residue containing nickel	166	--	
Platinum-group metals:			
Waste and sweepings value, thousands	$315	$402	All to Italy.
Metals including alloys, unwrought and partly wrought do	--	$31	All to Yugoslavia.
Selenium, elemental	5	9	All to United Kingdom.
Tin: Metal including alloys, unwrought	--	10	All to Italy.
Other:			
Ores and concentrates	34	82,861	All to Sweden.
Ashes and residues	--	19	All to Italy.
INDUSTRIAL MINERALS			
Cement	7,776	--	
Clays, crude	--	1	All to West Germany.
Graphite, natural	--	15	All to Spain.
Magnesium compounds	6,451	8,282	Hungary 7,802; Italy 480.
Pyrite, unroasted	24,592	24,852	Hungary 14,500; Italy 5,852; Yugoslavia 4,500.
Salt and brine	5,776	9,970	Yugoslavia 7,620; Italy 2,350.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	1,805	2,535	Poland 1,744; Italy 684; Yugoslavia 70.
Worked	2	153	All to Yugoslavia.
Sand other than metal-bearing	9	12,116	All to Greece.
Sulfur:			
Elemental:			
Crude including native and byproduct	1,164	--	
Colloidal, precipitated, sublimed	20	--	
Sulfuric acid	101	--	
Other: Crude	51	49	All to Italy.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	142	717	West Germany 658; Yugoslavia 59.
Carbon: Carbon black	5	--	
Coal: Anthracite and bituminous	25,670	--	
Coke and semicoke	13,520	3,950	All to Greece.
Petroleum refinery products:			
Liquefied petroleum gas thousand 42-gallon barrels	11	95	Italy 91; Yugoslavia 4.
Gasoline do	500	186	Italy 118; Spain 43; Hungary 25.
Kerosene and jet fuel do	2	2	All to Hungary.
Lubricants do	--	(2)	All to Yugoslavia.
Residual fuel oil do	18	--	
Bitumen and other residues do	8	383	Greece 267; Italy 12; Yugoslavia 4.
Unspecified do	175	--	

[p]Preliminary.

[1]Table prepared by Jozef Plachy. Owing to a lack of official data published by Albania, this table should not be taken as a complete presentation of this country's mineral trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries.

[2]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Unwrought	1,066	719	--	Hungary 660; Yugoslavia 48; Norway 11.
Semimanufactures	1,319	1,662	--	Hungary 1,042; Yugoslavia 460; Greece 73.
Copper: Metal including alloys:				
Unwrought	86	125	--	All from West Germany.
Semimanufactures	435	478	--	Yugoslavia 229; West Germany 121; Greece 105.
Iron and steel: Metal:				
Scrap	--	22	--	All from the Netherlands.
Pig iron, cast iron, related materials	1,308	2,793	--	All from Italy.
Ferroalloys:				
Ferrochromium	20	15	--	All from Yugoslavia.
Ferromanganese	625	1,403	--	Yugoslavia 1,343; West Germany 60.
Ferrosilicon	1,349	1,430	--	All from Yugoslavia.
Unspecified	14	10	--	All from West Germany.
Steel, primary forms	10	1	--	All from Italy.
Semimanufactures:				
Bars, rods, angles, shapes, sections	3,433	2,554	--	Yugoslavia 1,580; Hungary 587; West Germany 237.
Universals, plates, sheets	7,525	7,187	--	Poland 3,589; Hungary 2,658; Yugoslavia 422.
Hoop and strip	677	767	--	West Germany 644; Greece 80; Italy 25.
Rails and accessories	442	467	--	Yugoslavia 466; France 1.
Wire	467	438	--	Yugoslavia 174; Austria 131; West Germany 59.
Tubes, pipes, fittings	12,208	8,662	--	Greece 2,645; Austria 1,420; Hungary 1,251.
Unspecified	34,698	36,210	--	Czechoslovakia 20,000; Poland 16,210.
Lead: Metal including alloys:				
Scrap	--	10	--	All from West Germany.
Unwrought	21	8	--	Do.
Semimanufactures	--	58	--	West Germany 41; Belgium-Luxembourg 17.
Nickel: Metal including alloys, semimanufactures	2	3	--	All from Italy.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$1	$1	--	All from West Germany.
Silver: Metal including alloys, unwrought and partly wrought do.	$31	$22	--	Do.
Tin: Metal including alloys:				
Unwrought	61	26	--	Do.
Semimanufactures	3	--		
Titanium:				
Ore and concentrate	30	--		
Oxides	--	22	--	All from United Kingdom.
Tungsten: Metal including alloys, all forms	2	--		
Zinc:				
Oxides	50	--		
Metal including alloys, unwrought	10	56	--	All from West Germany.
Other:				
Ores and concentrates	18	--		
Oxides and hydroxides	--	2	--	All from United Kingdom.
Ashes and residues	7	4	--	All from West Germany.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Artificial: Corundum	294	306	--	Hungary 159; Yugoslavia 147.
Grinding and polishing wheels and stones	36	2	--	Italy 1; United Kingdom 1.
Asbestos, crude	1,523	1,545	--	Yugoslavia 1,526; Italy 19.
Barite and witherite	4,600	--		
Cement	60	--		
Clays, crude	257	180	--	France 141; Yugoslavia 39.
Diamond:				
Gem, not set or strung value, thousands	$19	--		
Industrial stones do.	--	$8	--	All from United Kingdom.
Diatomite and other infusorial earth	15	34	--	France 19; West Germany 15.
Feldspar, fluorspar, related materials	718	1,022	--	France 962; Yugoslavia 59; West Germany 1.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Fertilizer materials: Manufactured:				
Nitrogenous	1	--		
Phosphatic	25	--		
Potassic	5	1,049	--	Italy 1,040; West Germany 9.
Unspecified and mixed	--	5	--	All from United Kingdom.
Graphite, natural	7	17	--	Austria 11; West Germany 6.
Magnesium compounds	2,431	4,775	--	Yugoslavia 4,753; Italy 18; West Germany 4.
Mica: Worked including agglomerated splittings	3	--		
Phosphates, crude	39,200	51,870	--	All from Jordan.
Pigments, mineral: Iron oxides and hydroxides, processed	2	--		
Sodium compounds, n.e.s.: Carbonate, manufactured	2,500	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	37	77	--	All from Italy.
Worked	37	559	--	Do.
Gravel and crushed rock	23	--		
Sand other than metal-bearing	2,675	1,358	--	Yugoslavia 1,333; Netherlands 25.
Talc, steatite, soapstone, pyrophyllite	40	116	--	All from Italy.
Other: Crude	253	66	--	Greece 46; France 20.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1	16	--	All from United Kingdom.
Coal: Anthracite and bituminous	275,098	138,328	86,328	Poland 52,000.
Petroleum refinery products:				
Gasoline, 42-gallon barrels	4,956	4,080	--	All from Italy.
Mineral jelly and wax, do.	2,070	3,298	--	Yugoslavia 3,140; Italy 71; West Germany 47.
Kerosene and jet fuel, do.	--	1,721	--	United Kingdom 1,550; Italy 171.
Distillate fuel oil, do.	--	1,872	--	United Kingdom 1,865; West Germany 7.
Lubricants, do.	18,585	23,534	--	Yugoslavia 17,759; Italy 3,108; United Kingdom 980.

[p]Preliminary.

[1]Table prepared by Jozef Plachy. Owing to a lack of official trade data published by Albania, this table should not be taken as a complete presentation of this country's mineral trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries.

COMMODITY REVIEW

METALS

Chromite.—Chromite mining and processing remained Albania's principal nonfuel mineral activity and the country's second major source of foreign exchange. Albania's numerous chromite deposits were in the ultrabasic rocks within the ophiolitic complexes of the Midrita tectonic zone. About one-half of the country's marketable metallurgical-grade ore was mined in the Martanesh region of the Mat District at the Bulquizë Mine, northeast of Tirana. The average grade of ore at Bulquizë consisted of 42% Cr_2O_3, 13% FeO, and 22% Al_2O_3; reserves were determined at about 7 million tons. In 1987, construction was begun on a 7,360-meter-long inclined shaft at the Bulquizë chromite mine. When completed, the shaft would surface near the town of Klos and provide rapid transportation of ore to the beneficiation plant. Also, in the northeast section of the country, construction of a 3,300-meter-long tunnel was planned to link the Kalimash 1 and Kalimash 2 chromite mines to the concentrator. At the Burrel ferrochromium plant, a third 9,000-megawatt electric furnace was reportedly installed in August. The unit at full operational capacity was planned to boost the plant's ferrochromium output by 50%.

Copper.—On balance, Albania's main copper mines at Gjegjan, Kurbnesh, and Rubic met planned production goals for

1987. Primary copper was smelted at Gjegjan and Rubik. Refined metal was produced at Kruje and Rubic, and rolled copper and copper wire were produced at the Shkoder copper plant. Most semimanufactures produced at the Shkoder plant were exported to European market economy countries. In 1987, a new copper mine was put into operation at Karme, near Shkoder, and construction of a new beneficiation plant near the Gjegjan Mine in the Kukes District continued.

Nickel and Cobalt.—Construction of the cobalt-nickel refinery at Elbasan was further delayed by shortages of electricity and technical difficulties. The 6,000-ton-per-year refinery, designed to use domestic nickeliferous iron ore, was originally scheduled for startup in 1986. Its equipment was provided by Salzgitter Industriebau GmbH of the Federal Republic of Germany. Reportedly, the refinery was rescheduled for operational startup in the second half of 1988, and most of the cathode was to be exported to European market economy countries.

MINERAL FUELS

At yearend, Albania reported the startup of a new gas well at Povelce. Production of petroleum continued to suffer from a lack of technology and equipment necessary to increase output from the country's old oilfields, as well as from slow progress in bringing newer facilities on-stream.

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[1]Foreign mineral specialist, Division of International Minerals.
[2]Zeri i Popullit. Dec. 29, 1987, p. 1.
[3]———. July 12, 1987, p. 1.

The Mineral Industry of Algeria

By Kevin Connor[1]

Algeria's economy, which has historically depended on hydrocarbon revenues for almost all of its export earnings, recovered partially from the devastating effects of the crash in petroleum prices that occurred in 1986. Implementation of austerity measures by the Government and recovery in petroleum prices were cited as the two main reasons for the improvement. Government figures showed a trade surplus of $12 billion[2] for 1987, compared with a deficit of $1.4 billion in 1986. Owing to the strengthened petroleum prices, export receipts rose by 6.3% for the year. Total hydrocarbon revenues for 1987 were approximately $8 billion.

The Government's attempts to diversify exports away from dependence on the hydrocarbon area met with only minor success in 1987, with only 3% of total export revenues coming from nonhydrocarbon business. Contracts signed in 1987 for exports of steel products and other industrial goods to the U.S.S.R. could improve that figure substantially in 1988. The state hydrocarbon agency, Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation des Hydrocarbures (SONATRACH), continued despite contract problems to be the main supplier of natural gas to France in 1987, controlling almost a 35% share in that market. SONATRACH's nearest competitor was the U.S.S.R., which provided approximately 20% of French natural gas imports.

Government Policies and Programs.—Algeria's mineral investment spending in 1987 continued to favor the petroleum and natural gas sectors. Approximately $9.4 billion was expended by the Government in the hydrocarbon sectors, which was approximately 50% of the entire Government investment budget for the year. In all other areas of mining combined, only an estimated $60 million was spent. Investment spending in 1988 was budgeted to increase 5.6%, with approximately the same distribution trend as in 1987. To stimulate international interest in hydrocarbon exploration, Algeria passed legislation in 1986 allowing a foreign partner to own 49% interest in any such venture. In December, Azienda Generali Italiana Petroli S.p.A. (AGIP) of Italy became the first firm to sign an agreement under the terms of the 1986 law. Two other Western European firms were close to signing exploration agreements under the new law at yearend, Compañia Española de Petróleos S.A. of Spain and Compagnie Française des Pétroles-Total (CFP-Total).

SONATRACH made an application to acquire 15% of the Belgium state gas firm Distrigaz S.A. SONATRACH and Distrigaz have been in a contract dispute over underlifting of Algerian gas by Distrigaz since 1986.

PRODUCTION AND TRADE

Production of most of Algeria's minerals remained constant or showed only a small change in 1987. There were decreases in both the phosphate and mercury sectors, owing mostly to depressed market conditions. Algeria continued to be a major world producer of natural gas and condensates, by far the largest producer within the Organization of Petroleum Exporting Countries (OPEC) cartel. Except for the country's natural gas and petroleum industries, Algeria's mineral sector was small by interna-

tional standards, with only iron ore, mercury, and phosphate rock produced in significant amounts. Other minerals produced included antimony, barite, celestite, clays, lead-zinc ores, limestone, and salt.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Cadmium, refined[e]	--	80	128	124	125
Copper concentrate:					
Gross weight	600	820	--	--	--
Cu content	130	115	--	--	--
Iron and steel:					
Iron ore, gross weight thousand tons	3,684	3,664	3,776	3,360	[3]3,380
Metal:					
Pig iron[e] do.	[3]1,100	1,100	1,100	1,100	1,100
Steel, crude[e] do.	600	600	700	750	750
Lead concentrate, Pb content[e]	3,000	4,000	3,800	3,600	3,600
Mercury 76-pound flasks	10,000	23,000	23,000	22,000	22,000
Silver[e] thousand troy ounces	120	120	120	120	120
Zinc:					
Concentrate, Zn content	12,100	14,600	13,500	14,000	14,000
Smelter	31,200	35,000	35,700	34,500	35,000
INDUSTRIAL MINERALS					
Barite, crude	110,000	88,000	60,000	60,000	60,000
Cement, hydraulic[e] thousand tons	4,800	5,500	[3]6,096	[3]6,460	6,500
Clays:					
Bentonite	30,000	24,500	33,000	30,000	30,000
Fuller's earth[e]	5,000	3,500	3,500	3,500	3,500
Kaolin	17,000	8,000	13,000	14,200	14,000
Diatomite	4,500	1,600	2,600	4,000	4,000
Gypsum and plaster[e 4] thousand tons	250	250	250	275	275
Lime, hydraulic[e] do.	40	40	40	40	40
Nitrogen, N content of ammonia	131,500	146,300	150,000	150,000	150,000
Phosphate rock thousand tons	893	1,000	1,207	1,203	[3]1,073
Salt do.	150	175	168	190	200
Sodium compounds: Caustic soda[e]	700	700	700	700	700
Strontium minerals: Celestite, gross weight[e]	5,400	5,400	5,400	5,400	5,400
Sulfur, elemental[e]	15,000	20,000	20,000	20,000	20,000
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural:					
Gross million cubic feet	3,173,000	3,223,000	3,543,000	3,440,000	3,400,000
Marketed do.	1,427,000	1,545,000	1,560,000	1,590,000	1,600,000
Natural gas plant liquids thousand 42-gallon barrels	91,500	118,950	122,275	[e]122,000	125,000
Petroleum:					
Crude do.	240,900	233,508	234,095	[e]234,000	234,000
Refinery products:					
Gasoline do.	12,045	12,045	[e]13,000	[e]13,000	13,000
Kerosene and jet fuel do.	4,745	4,745	[e]5,500	[e]5,500	5,500
Distillate fuel oil do.	52,925	52,925	[e]53,000	[e]53,000	53,000
Residual fuel oil do.	34,675	35,040	[e]37,000	[e]37,000	37,000
Lubricants do.	365	730	[e]350	[e]350	350
Other do.	40,515	52,560	[e]37,500	[e]37,500	37,500
Refinery fuel and losses do.	7,300	6,205	[e]9,000	[e]9,000	9,000
Total do.	152,570	164,250	[e]155,350	[e]155,350	155,350

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

[1]Table includes data available through June 29, 1988.

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

[3]Reported figure.

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

COMMODITY REVIEW

METALS

In midyear, a group composed of the Lavalin Corp. and Met-Chem Canada, both of Canada, was awarded a consultancy contract to advise the Algerian steel agency, Entreprise Nationale de Siderurgie (Sider), on planning and purchasing decisions for the Bellara steelworks project. The 1.1-million-ton-per-year-capacity steel plant project was expected to cost $1.5 billion to $2 billion to build on a turnkey contract basis. Several international companies submitted supply tenders for the project in midyear, and the Canadian consultants were expected to help Sider evaluate the bids. Construction of the steel plant was expected to get under way sometime in 1989, and was expected to take 4 years to complete. Two companies offered bids by yearend on the direct-reduction process for the blast furnace plant. Kawasaki Steel Corp. of Japan was offering the HYL process, and Voest-Alpine AG of the Federal Republic of Germany was offering the Midrex process.

INDUSTRIAL MINERALS

Fertilizer Materials.—In August, international and local companies were invited to prequalify for upgrading one of the ammonium nitrate units at the Annaba fertilizer complex. The new unit was to produce nitrogen-phosphate-potash fertilizer (NPK). The unit was to rely on nitric acid, rather than sulfuric acid, for dissolving the phosphate used in producing the NPK product. The project called for the eventual conversion of two of the nitric acid units at the Annaba complex into NPK producers. The third nitric acid unit would continue to produce approximately 850 tons per day of ammonium nitrate. There were technical problems with using Algerian phosphate for the NPK production, and importing Tunisian phosphate as feedstock was being considered.

The Annaba ammonia plant, which was essentially completed in 1981, was finally commissioned in midyear. Even though the plant has been in operation, technical problems have plagued the plant since its completion. The M. W. Kellogg Co. of the United States had assisted the state fertilizer agency Asmidal in correcting the problems with plant operations. The plant, built by Creusot Loire Entreprise Groupe Technip of France, was designed to use the Kellogg process. Ammonia storage tanks, built by a Japanese consortium led by Toyo Kanetsu, were completed in 1984.

Salt.—In July, bids were invited from both local and international companies for an estimated $10 million to $15 million project to develop Algeria's Chott Merouane salt deposits. Chott Merouane, a lake with high salinity, is on a plateau near the Tunisian border. The project was expected to be completed in two phases. The first phase would involve detailed studies of the deposits, including construction of crystallization ponds and drainage channels. Phase 2 would involve detailed studies and installation of equipment for a washing plant at El Meghaier. A bagging plant would also be built as part of the second phase. An original feasibility study was completed on the project by Saltec Lavalin of Canada in 1985. All bids were to have been submitted to Algeria's state agency, Entreprise Nationale de Sel, by mid-October. No results of the bidding were known at yearend.

MINERAL FUELS

Natural Gas.—Gross production of natural gas was estimated at 3.4 trillion cubic feet in 1987. Nearly one-half of this output or 1.6 trillion cubic feet was reinjected into petroleum reservoirs. Venting and flaring of natural gas was minimal and reported at 275 billion cubic feet. About one-half of the remaining natural gas production was exported. The European market was Algeria's principle output with Italy and France each importing well over 300 billion cubic feet in 1987.

Petroleum.—*Exploration.*—In October, SONATRACH announced an oil discovery in the Erg region of Algeria, approximately 200 miles east of Hassi Messaoud. No flow rates were given, but the crude was described as high quality. AGIP found oil in this area in 1986. AGIP extended its exploration contract in early 1987, then finalized a new production-sharing contract with SONATRACH in December under the amended petroleum code of 1986. AGIP's original agreement on the Erg permit was signed in 1980. The discovery well was AGIP's second attempt in the 9,100-square-kilometer permit. Crude was found at depths of 3,307 meters and 3,387 meters. The site is relatively close to existing petroleum infrastructure at Hassi Messaoud, and nearby the El-Borma crude pipeline of Tunisia; therefore, infrastructure costs could be minimized. CFP-Total also found oil in the

Erg area but decided not to develop its find owing to the estimated infrastructure costs. Depending on the findings of AGIP's planned additional drilling at Erg, and final decision on development in the area, CFP-Total may reevaluate its decision.

Production.—In April, a new production-sharing agreement for the Mereksen Oilfield was signed between SONATRACH and CFP-Total. The accord extends for 5 years the 12-year agreement originally signed in 1975. With the signing of the renewed accord, CFP-Total was entitled to 49% of the oil produced from the field until expiration of the agreement in March 1992. CFP-Total and SONATRACH were expected to consider seriously installation of gas reinjection equipment for Mereksen, which has been declining in annual production since its peak of 40,000 barrels per day in the late 1970's. The average production in 1987 was slightly over 13,000 barrels per day, approximately 2% of the country's output. The Mereksen Field, in the Stah area, is one of the last in Algeria where foreign companies have production entitlements. The only other foreign entitlements are held by Spain's Hispanoil and Brazil's Braspetro, both of which produced only at a rate of several hundred barrels of oil per day in 1987. Before 1980, CFP-Total also had entitlement in three other Algerian oilfields, a situation that was disrupted in 1980 by disagreements between Algeria and France over gas pricing.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Algerian dinars (DA) to U.S. dollars at the rate of DA50=US$1.00.

The Mineral Industry of Angola

By Thomas O. Glover[1]

During 1987, Angola continued its struggle to improve its economic conditions. However, the country suffered from unstable prices of crude oil for the second consecutive year. The civil war continued to cause devastating social and economic problems throughout Angola. More than 50% of both the foreign debt and the national budget was related to military expenditures.

The petroleum industry of Angola accounted for more than 90% of total foreign exchange earnings. Cabinda Gulf Oil Co. (CABGOC), owned jointly by Chevron Oil Corp. (49%) and Sociedade Nacional de Combustiveis de Angola (SONANGOL) (51%), produced approximately 70% of Angola's total crude oil production for the year.

The only other mineral important as a foreign exchange earner was diamond. Ravaged for years by civil war, diamond operations in Angola closed in 1986. Diamond mining operations restarted in 1987 after Angola entered into new mining contracts with Roan Selection Trust (RST), Metal and Minerals Trading Corp. of India (MMTC), and Lonrho PLC of the United Kingdom.

Angola exported approximately 315,000 barrels per day (bbl/d) of crude oil. Exports of crude were approximately 25% higher in 1987 compared with those of 1986. The increased crude oil production came mostly from the development of Chevron's fields offshore of Cabinda and the Société Nationale Elf Aquitaine (Elf) fields onshore.

Reliable information on the mineral industry of Angola remained difficult to acquire owing to the constant upheaval caused by the civil war. The few reports that were available showed the industry deteriorating. Crude oil and diamonds remained the only minerals of promise in an otherwise diminishing economy.

Geologists from the Soviet Ministry of Geology have produced a new map of Angola enabling them to evaluate the country's geological structure and mineral deposits. The map indicated that Angola had coal deposits that were previously unknown.

A rehabilitation program for the Benguela Railroad was arranged on April 16, 1987, by Angola, Mozambique, Zaire, and Zambia at an estimated cost of $280 million.[2] No maintenance work had occurred since 1975. The east-west railroad, 838 miles in length, runs from the coastal port of Lobito across Angola to the Copperbelt in Zaire. The rehabilitation of the line was scheduled to be completed in 2 years. In addition to the rehabilitation of the trackage, 12 diesel-electric locomotives were purchased from Brazil at a cost of $15.3 million. The Benguela railway, principally owned by the Société Generale de Belgique, was scheduled for new ownership that would repair and operate the railway. Operational safety and attacks by guerrilla forces were of prime concern.

PRODUCTION AND TRADE

In 1987, petroleum sales brought approximately $2.1 billion in revenue. This represents a 75% increase in revenues from those of 1986 due to a small increase in oil prices and a considerable increase in production. Crude oil exports accounted for the major part of the country's export revenue.

The African Petroleum Producers Associ-

ation was formed in January 1987 by eight African oil exporting countries, of which Angola became a charter member. The other members are Algeria, Benin, Cameroon, Congo, Gabon, Libya, and Nigeria. The members represent about 80% of total African oil production of 5.2 million bbl/d in 1987.

Both CABGOC and Elf have predicted large increases in oil production by 1990. Angola was expecting an approximate 50% increase compared with that of 1987, projecting total production of more than 500,000 bbl/d by 1990. Angola's mineral fuels reserves were 1.149 billion barrels of oil and 1.76 trillion cubic feet of natural gas by yearend. Of the 342,000-bbl/d production in 1987, 68% came from the Cabinda enclave and 24% from Elf fields.

Angola exported approximately 1.4 million barrels of crude oil to Portugal in late 1987 to pay interest as well as part of the principal on its 1986-87 debt to that country. The amount totaled approximately $25 million. Angola doubled its oil exports to Brazil to approximately 20,000 bbl/d for which Brazil doubled its credit line to Angola. Due to this action, Brazil became a principal trading partner and investor in the Angolan private and public sectors. The bulk of Brazilian investment ($1 billion) in Angola was concentrated in the construction of the Kapanda Dam.

Angola's principal sale of crude oil in 1987 was to the United States. The 177,438-bbl/d crude oil exports to the United States came from the Cabinda enclave, representing 60% of Cabinda's production and 3.8% of the total crude oil imports to the United States.

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

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
Asphalt and bitumen, natural[e] ___ metric tons__	25,000	25,000	25,000	25,000	25,000
Cement, hydraulic[e] _____ thousand tons__	220	350	350	350	350
Diamond:					
Gem[e] _____ thousand carats__	775	[r]652	[r]464	240	180
Industrial stones[e] _____ do____	259	250	250	10	10
Total _____ do____	1,034	[r]902	714	250	190
Gas, natural:[e]					
Gross_____ million cubic feet__	55,000	55,000	55,000	55,000	55,000
Marketable _____ do____	2,500	2,500	2,500	2,500	2,500
Gypsum[e] _____ metric tons__	20,000	20,000	20,000	20,000	20,000
Iron and steel: Steel, crude[e] _____ do____	10,000	10,000	10,000	10,000	10,000
Petroleum:					
Crude _____ thousand 42-gallon barrels__	58,400	73,000	89,060	102,200	124,830
Refinery products[e] _____ do____	NA	10,000	10,000	10,000	10,000
Salt[e] _____ metric tons__	55,000	50,000	10,000	10,000	10,000

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through May 2, 1988.
[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.

COMMODITY REVIEW

INDUSTRIAL MINERALS

Ravaged by 12 years of civil war, the diamond industry of Angola showed signs of revival in 1987 after ceasing all operations in July 1986. Sabotage, hostage-taking, tumbling diamond prices, and the smuggling of diamonds all contributed to the 1986 closing. In October 1986, RST signed a contract with Empresa Nacional de Diamantes de Angola (Endiama) to mine in the rich Cuango alluvial deposits. Angola, now free of De Beer's Central Selling Organization, began sales of diamonds on a monthly basis in April 1987 at Luanda's Banco Nacional. A considerable, but undisclosed, proportion of the diamonds being sold came from the RST workings.

MMTC negotiated a long-term contract with Endiama to purchase rough diamonds. State-owned MMTC has offered to purchase up to 1 million carats per year from Angola, which would amount to a total yearly production of the early 1980's. The production was estimated to be 190,000 carats in 1987, of which 95% was gem quality. MMTC has also proposed that it provide technical and financial assistance in mining and diamond sorting.

MINERAL FUELS

Angola's crude oil production was estimated to be about 342,000 bbl/d in 1987, an increase of 22% over that of 1986. Total crude production was approximately 125 million barrels, resulting in estimated export earnings of $2.1 billion, which represented a 75% increase in earnings compared with those of 1986.

An Italian oil-drilling platform, from the Italian firm Saipem S.p.A., arrived in Luanda in October 1987. The platform, scheduled to operate in Soyo's No. 1 offshore block, can operate at a water depth of 90 meters and can drill in excess of 6,000 meters. The platform was scheduled to drill the No. 2 Safueiro well in Soyo's No. 1 offshore block. The oil exploration operations are to be conducted by Azienda Generali Italiana Petroli S.p.A. (AGIP) of Italy for SONANGOL.

During the last quarter of 1987, Italy's AGIP was negotiating with Chevron to acquire a 9.8% interest in the oilfields operated at the offshore Cabinda enclave. AGIP was selected by SONANGOL as the potential partner for Chevron. Production of crude by Chevron at the Cabinda enclave was approximately 270,000 bbl/d by year-end. AGIP, with production operations in the Congo, would acquire 20% of Chevron's 49% holdings with the other 51% held by SONANGOL.

Texaco Angola Prospecção e Pruducas (Teipac) S.A.R.L., operator of offshore Block 2, discovered two fields on its 1-million-acre block that produced approximately 5,000 bbl/d. The company was developing three additional fields that were expected to bring total production to 35,000 to 40,000 bbl/d within 2 years. Texaco had a 40% interest in Block 2 and SONANGOL, 25%, whereas Cie. Française des Pétroles S.A. of France and Braspetro of Brazil each had 17.5%. AGIP was negotiating with Texaco on purchasing 50% of its 40% holdings in Block 2. Elsewhere in Angola, Texaco had a 16.33% interest in an onshore area called the FST Block. The FST Block was operated by Petrofina S.A. of Belgium with 32.67%, and SONANGOL with 51%. The FST Block had 11 fields that produced approximately 30,000 bbl/d during the year. Another U.S. company, Conoco Inc., was doing limited exploration drilling.

Elf took delivery from Brasoil, a subsidiary of Petrobras International S.A., of the $26.7 million, 75,000-bbl/d PALP-2 processing platform for its Palanca Oilfield. The platform was erected in 157 feet of water, 22 miles offshore, and about 143 miles north of Luanda.

The only petroleum refinery in Angola was operated by Cia. de Pétroleos de Angola. The refinery processing capacity amounted to 1.5 million tons of crude annually. During 1987, the operation produced at or near capacity.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been estimated to be convertible from Angolan kwanzas (Kz) to U.S. dollars at the rate of Kz35.00=US$1.00 for 1987.

The Mineral Industry of Argentina

By Pablo Velasco[1]

Argentina, the second largest country in Latin America, has considerable and well-diversified natural resources and a particularly favorable geological setting for mining. In the past 25 years, the Government has directly or indirectly expended a considerable effort on exploration, generating the discovery of a number of mineral deposits, most of them medium-size and polymetallic. But no followup investments have been made to develop these deposits. Therefore, the mining sector is one of the least developed sectors of the Argentine economy. The mineral sector's contribution to the gross domestic product (GDP) has ranged between 0.3% and 0.4% per year. Mineral trade has been irregular and has remained negligible in terms of total exports. However, a number of mining-related companies were expanding and were expected to increase the output and trade income of Argentina in the near future. These included aluminum, Aluminios Argentinos S.A.I.C. (ALUAR); coal, Yacimientos Carboníferos Fiscales (YCF); natural gas and crude oil, Yacimientos Petrolíferos Fiscales (YPF); iron ore and phosphorus, Hierro Patagónico S.A. Minera (HIPASAM); gold and silver, Yacimientos Mineros de Agua de Dionisio (YMAD); sulfur, La Casualidad; and manganese, Pozo Nuevo.

The U.S. interests in the mining sector of Argentina remained small. The El Aguilar lead, zinc, and silver mine in Jujuy Province, owned by St. Joe Minerals Corp. and considered as the most significant private mining venture in Argentina, was reportedly up for sale after 58 years of uninterrupted operation.

Argentina's economy registered moderate growth of just above 2% or less than one-half the level achieved in 1986. Available data as of mid-1987 indicated that the rebound in overall investment continued despite tight credit conditions during most of the year. The growing public-sector deficit and an expansionary monetary policy contributed to a rebound in inflation in 1987, continuing a trend that began in mid-1986. In October, the Government proposed an economic adjustment package similar to the 1985 Austral Plan, including a wage and price freeze, a sharp increase in taxes, and trade and financial reforms.

A demonopolization decree signed in November would permit private mining companies to operate on public lands reserved for state-owned enterprises.

Argentine laws on foreign investment were considered among the most open and liberal in Latin America. In general, foreign investors enjoy all the rights and incentives given to domestic investors.

In a major departure from previous policy on foreign investment in petroleum, during 1985 the Government invited foreign oil companies to participate in exploration contracts in areas reserved for YPF. Additional areas were opened for a second round of bids in late 1986, and a third round (including 30 new areas for exploration) was launched in May 1987. In 1987, the United States and Argentine Governments agreed to reopen Overseas Private Investment Corp. (OPIC) activities in the country.

Government Policies and Programs.—The Secretariat of Mining on November 25 officially transmitted a revised national mining code to the National Congress for approval in an extraordinary session. The aim of the new code was to give incentives that would consolidate the mining industry, dominated by small-scale operations, into larger, more productive operations. Domes-

tic and foreign investment would be encouraged by eliminating the progressive tax on profits, which was more than 12%. According to officials who drafted the reformed code, all the necessary rights for mining operations would be granted to the private sector as well as state monopoly operations.

According to Government statistics, only 500 out of 30,000 registered mines in the country were in production in 1987, and only a few of them were making some profit. The proposed reforms to the mining code were expected to rekindle mine development. Owners of mining concessions would be required to demonstrate through exploration that their mineral deposits are technically and economically feasible or the concession would revert to the state. The proposed legislation continued to be controversial among mine operators, owners of idle mines or unworked mining claims, and some Provincial officials. Proponents claimed that the new mining code would attract foreign investment. Government officials emphasized that Argentina must make full use of its vast mineral resources to increase exports and expand the economy.

The Secretary of Mining stated that a plan was being drawn up with the Inter American Development Bank to stimulate the mineral industry, and that technical cooperation agreements were being developed with France, the Federal Republic of Germany, and other countries. The Government's objective was to achieve a positive mineral trade balance by the year 2000 by increasing metals production domestically and replacing a variety of mineral imports.

PRODUCTION

Despite market uncertainties, production of metallic minerals decreased significantly in the 1984-87 period: 12 metallic minerals showed increases while only 3 had decreases. During this period, 24 industrial minerals registered increases and 11 registered decreases in production. The depressed international market affected deeply the tungsten and tin companies, which had high operating costs and relatively low ore grades. Production of industrial minerals that were internationally traded showed a sustained growth. Domestic demand remained stagnant.

Construction materials (rocas de aplicación), which included sand and gravel, granite, marble, and other building stones, were sensitive to investment in construction and remained fairly depressed. Output of cement and construction stone began to increase in the later months of the year. Marble and granite showed some promising trends in foreign markets. YCF, the state-owned coal company, reported a 17% production increase in 1987. The production of crude oil and natural gas continued its downtrend, declining in 1987 to 156 million barrels and almost 676 billion cubic feet, respectively.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Primary	132,800	137,821	139,947	150,700	155,000
Secondary	7,000	[r]7,500	3,600	3,600	3,600
Beryllium: Beryl concentrate:					
Gross weight	24	[r]72	31	50	40
BeO content	2	[r]7	3	5	4
Cadmium: Smelter	21	46	46	[e]47	46
Copper: Mine output, Cu content	318	223	391	317	300
Gold: Mine output, Au content ___troy ounces__	24,660	22,120	28,357	30,350	30,000
Iron and steel:					
Iron ore and concentrate:					
Gross weight _____ thousand tons__	590	572	639	810	[3]762
Fe content	337	346	389	514	484
Metal:					
Pig iron and sponge iron _____do____	1,862	1,799	2,999	[e]2,600	[3]2,785

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS —Continued					
Iron and steel —Continued					
Metal —Continued					
Ferroalloys, electric-furnace:					
Ferromanganese	25,004	23,976	23,663	19,782	20,000
Ferrosilicomanganese	13,523	13,336	7,493	12,977	12,000
Ferrosilicon	15,454	19,932	18,790	22,979	22,000
Other	264	3,939	4,892	5,272	5,000
Total	54,245	61,183	54,838	61,010	59,000
Steel, crude thousand tons	2,943	2,647	2,942	3,235	[3]3,633
Semimanufactures[4] do	2,864	2,456	2,269	2,977	2,900
Lead:					
Mine output, Pb content	31,684	28,542	28,582	28,868	[3]28,800
Metal:					
Smelter, primary	15,200	16,300	15,088	[e]20,000	20,000
Refined:					
Primary	15,200	16,300	15,088	24,324	20,000
Secondary	16,070	15,000	13,575	[e]15,000	15,000
Total	31,270	31,300	28,663	39,324	35,000
Manganese ore and concentrate:					
Gross weight	6,926	[r]5,888	7,276	9,886	10,000
Mn content	1,463	[r]1,443	1,728	2,458	2,000
Silver, mine output, Ag content thousand troy ounces	2,500	1,984	2,170	2,134	2,000
Tin:					
Mine output, Sn content	291	274	451	379	350
Metal, smelter	254	292	135	365	350
Tungsten, mine output, W content	41	37	17	20	20
Uranium, mine output, U_3O_8 content kilograms	135,000	94,430	129,560	177,290	180,000
Zinc:					
Mine output, Zn content	36,586	34,909	35,713	39,540	37,000
Metal:					
Smelter:					
Primary	30,000	27,725	30,377	29,123	30,000
Secondary	2,000	2,200	2,500	3,000	4,500
Total	32,000	29,925	32,877	32,123	34,500
INDUSTRIAL MINERALS					
Asbestos	1,240	1,093	1,244	1,697	1,000
Barite	61,094	44,170	55,753	58,617	58,000
Boron materials, crude	113,123	142,800	158,252	191,871	160,000
Cement, hydraulic thousand tons	5,623	5,120	4,646	5,535	6,310
Clays:					
Ball clay (plastic clay), n.e.s do	1,853	1,870	1,595	1,580	1,580
Bentonite	135,569	[r]125,703	147,065	146,191	145,000
Foundry earth	115,260	124,023	96,821	102,551	100,000
Fuller's earth (decolorizing clay)	6,741	3,611	1,743	2,000	2,000
Kaolin	145,098	90,545	73,802	117,378	100,000
Laterite (aluminous)	23,881	31,902	32,086	38,816	35,000
Refractory	73,352	70,250	38,388	72,185	70,000
Other[5]	459,208	665,615	524,267	1,596,852	900,000
Diatomite	10,981	5,227	9,929	14,362	10,000
Feldspar	20,065	17,948	27,066	16,314	15,000
Fluorspar	28,985	23,157	30,612	39,076	30,000
Graphite	20	15	32	40	35
Gypsum, crude	578,188	566,943	460,816	462,195	460,000
Lithium: Spodumene, amblygonite, gross weight	152	[r]25	35	184	100
Mica:					
Sheet	28	12	347	234	200
Waste and scrap	285	278	374	323	300
Nitrogen: N content of ammonia	57,500	49,300	64,900	[e]50,000	[3]62,879
Phosphates: Thomas slag[6]	600	500	500	228	110
Pigments, mineral, natural: Ocher	853	757	4,020	1,027	1,100
Precious and semiprecious stones: Amethyst kilograms	26,000	NA	NA	NA	NA
Pumice and related volcanic materials	68,624	54,257	44,350	22,957	25,000
Salt:					
Rock thousand tons	1	1	1	1	1
Solar do	677	937	1,447	1,218	1,200
Total do	678	938	1,448	1,219	1,201

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Sand and gravel:					
Sand:					
Construction thousand tons	12,524	11,399	11,352	10,389	10,500
Ferruginous-titaniferous	--	NA	NA	NA	NA
Silica sand (glass sand) thousand tons	314	306	275	292	280
Gravel do	5,878	4,301	3,745	5,552	5,000
Stone:					
Basalt do	2,894	r3,354	3,020	2,802	2,900
Calcareous:					
Calcite, nonoptical	7,520	7,100	8,220	7,687	7,500
Calcium carbonate (chalk)	8,325	8,585	12,629	13,448	13,000
Dolomite	239,496	211,270	397,146	254,966	300,000
Limestone thousand tons	12,318	11,167	10,064	10,166	10,000
Marble:					
Aragonite, broken	4,872	2,603	1,032	513	1,000
Onyx, in blocks and broken	16,359	r13,592	11,041	9,351	9,000
Travertine, in blocks and broken	5,686	4,447	6,007	4,423	5,000
Unspecified, in blocks and broken	74,284	92,282	71,042	98,227	85,000
Flagstone	80,508	41,180	61,425	53,943	60,000
Granite:					
In blocks	41,554	25,359	32,948	30,424	31,000
Crushed thousand tons	5,712	4,144	3,653	3,757	3,600
Quartz, crushed	81,615	96,420	81,213	68,002	70,000
Quartzite, crushed thousand tons	765	996	1,105	580	600
Rhodochrosite	45	23	6	13	10
Sandstone	28	200	282	346	300
Serpentine, crushed	22,460	5,146	12,551	23,010	18,000
Shell, marl	718,000	556,949	431,990	320,898	350,000
Tuff and tufa thousand tons	1,031	458	1,876	1,306	1,500
Strontium minerals: Celestite	673	400	983	1,133	1,000
Sulfates, natural:					
Aluminum (alum)	12,983	11,583	24,513	30,489	30,000
Magnesium (epsomite)	828	r697	904	762	800
Sodium (mirabilite)	45,065	32,626	20,865	31,789	32,000
Talc and related materials:					
Pyrophyllite	4,925	5,012	2,785	2,812	3,000
Steatite	1,387	NA	280	e300	300
Talc	23,379	22,774	15,944	22,353	20,000
Total	29,691	27,786	19,009	r e25,465	23,300
Vermiculite	3,951	4,451	4,887	5,207	5,000
Water, mineral-containing	76,819	85,436	100,720	151,998	140,000
Zeolite	60	90	103	120	110
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural	2,912	994	3,235	3,702	e3,500
Coal, bituminous thousand tons	486	509	400	450	e525
Coke, all types, including breeze do	450	r422	625	840	e700
Gas, natural:					
Gross million cubic feet	606,742	662,645	709,317	677,407	e675,482
Marketed do	78,651	78,081	78,081	78,204	e74,906
Natural gas liquids:					
Butane thousand 42-gallon barrels	2,374	2,605	3,132	3,170	e3,306
Propane do	3,193	3,497	2,996	3,030	e4,967
Total do	5,567	6,102	6,128	6,200	e8,273
Peat, agricultural (turba)	3,726	2,308	3,917	3,166	3,500
Petroleum:					
Crude thousand 42-gallon barrels	179,097	175,097	167,781	158,467	e156,284
Refinery products:					
Gasoline do	43,663	43,817	34,785	31,351	e38,614
Kerosene do	4,095	3,549	3,449	3,675	e2,506
Jet fuel do	4,852	5,143	4,685	5,028	e5,865
Distillate fuel oil do	56,342	57,265	48,801	51,429	e54,137
Residual fuel oil do	43,285	38,448	17,485	21,447	e31,733

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Lubricants thousand 42-gallon barrels	1,968	1,883	1,593	1,792	[3]2,045
Other do	7,145	8,565	10,417	16,148	[3]8,271
Refinery fuel and losses do	14,612	11,766	43,982	25,337	[3]9,975
Total do	175,962	170,436	165,197	156,207	[3]153,146

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

[1]Table includes data available through June 30, 1988.

[2]In addition to the commodities listed, bismuth, carbon black, columbite, lime, natural gasoline, perlite, and potassium sulfate (kalinite) are or are believed to be produced, but output is not reported quantitatively, and available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

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

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

[6]Thomas slag production was estimated from the Thomas crude steel reported in La Siderurgia Argentina's annual publication and from reports published by the Instituto Argentino de Siderurgia.

TRADE

Official reports for 1984-87 showed that the value of exported minerals, mineral-related products, and metals amounted to $130 million[2] or an average of $32.5 million per year. The principal mineral exports during that period were mainly bentonite, borates, portland cement, granite, gypsum, lead, and zinc. These accounted for the major part of the value of the mineral exports. There was a significant diversification in mineral exports: 54 different minerals were exported in 1984, 71 in 1985, and 67 in 1986 and 1987. Brazil remained the single largest importer of Argentine minerals throughout the period, accounting for approximately 53% of the total. Other important mineral markets included the United States, Japan, Eastern Europe, and the U.S.S.R. Argentine minerals found it hard to compete outside Latin America because of the heavy costs of ocean freight.

The Secretariat of Mining and the National Institute of Statistics and Census traditionally group together import figures for minerals and basic manufactures derived from mineral substances. During 1984-87, the values for these commodities varied significantly, from $825 million in 1984 to $565 million in 1985 to $746 million in 1986 and 1987. In 1987, mineral imports accounted for almost 20% of the total.

Asbestos, kaolin, magnesium, and sulfur, among industrial minerals, accounted for 79% of the total mineral imports for the 4-year period. Imports of metallic minerals comprised mostly iron ore, manganese, and other minerals used in steelmaking. In 1987, $147 million was spent on calcined alumina (for the manufacture of aluminum) and on sodium carbonate. Imports of pigments were valued at $20 million comprising mostly titanium dioxide.

The export value of crude oil and refinery products in 1987 decreased 31% to $104 million. Imports of natural gas were down to 75 billion cubic feet. Imports of coal from the United States and other countries increased 8% to 1.2 million tons. Argentina produced and exported electrical cable with the copper that it bought from Chile and Brazil. It exported aluminum products derived from Australian alumina. It also exported steel and seamless pipe manufactured with iron and manganese from Brazil and Peru.

Table 2.—Argentina: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	4	1	--	Mainly to Uruguay.
Metal including alloys:				
Unwrought	98,065	74,000	23,007	Japan 35,425; Netherlands 8,275.
Semimanufactures	8,444	13,469	6,010	Netherlands 5,196; Japan 1,106.
Beryllium: Ore and concentrate	31	--		
Chromium: Oxides and hydroxides	--	13	--	Mainly to Chile.
Copper: Metal including alloys:				
Unwrought, value, thousands	$7	$4	--	Greece $2; Chile $1; Uruguay $1.
Semimanufactures	1,764	3,144	2,961	Canada 100; Uruguay 41.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	2	--		
Metal:				
Scrap	--	9	--	All to Brazil.
Pig iron, cast iron, related materials	602	45	--	Chile 25; Uruguay 20.
Ferroalloys	9,741	9,840	553	Japan 9,039; United Kingdom 126.
Steel, primary forms	295,089	369,796	--	China 275,183; India 62,166; Italy 14,827.
Semimanufactures:				
Bars, rods, angles, shapes, sections	382,012	249,578	21,163	China 136,437; Chile 33,578.
Universals, plates, sheets	187,450	315,539	112,482	Thailand 54,257; Japan 38,427.
Hoop and strip	28	178	--	Uruguay 170; Chile 8.
Rails and accessories	64	NA		
Wire	8,135	3,795	713	Cuba 1,842; Paraguay 412.
Tubes, pipes, fittings	241,757	228,217	28,022	China 73,369; U.S.S.R. 68,951.
Castings and forgings, rough	12	196	155	Bolivia 30; Uruguay 11.
Lead:				
Ore and concentrate	19,854	17,080	--	Brazil 10,400; France 3,501; Belgium-Luxembourg 3,179.
Oxides	8	83	--	Uruguay 82; Paraguay 1.
Metal including alloys:				
Unwrought	--	50	--	All to Uruguay.
Semimanufactures	2	1	--	All to Paraguay.
Magnesium: Metal including alloys:				
Unwrought	16	--		
Semimanufactures value, thousands	$2	--		
Nickel: Metal including alloys, semimanufactures	--	1	--	NA.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, platinum, value, thousands	--	$1	--	All to Paraguay.
Silver: Metal including alloys, unwrought and partly wrought, do.	$9	--		
Tin:				
Ore and concentrate	703	3	--	All to Paraguay.
Metal including alloys, semimanufactures	1	1	--	All to Uruguay.
Tungsten: Metal including alloys, all forms, value, thousands	--	$11	$11	
Zinc:				
Ore and concentrate	7,761	7,602	--	All to Brazil.
Oxides	92	341	--	Cuba 209; Brazil 75; Chile 55.
Metal including alloys:				
Unwrought	8,900	762	--	Japan 702; Uruguay 60.
Semimanufactures	5	11	--	Bolivia 7; Uruguay 4.
Other:				
Ores and concentrates	31	50	50	
Ashes and residues	20	--		
Base metals including alloys, all forms, value, thousands	$315	$13	--	Mexico $8; Nicaragua $2; Uruguay $2.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	--	62	--	All to Uruguay.
Grinding and polishing wheels and stones	1	4	--	Brazil 2; Peru 1.
Asbestos, crude	23	15	--	All to Uruguay.
Barite and witherite	17	530	--	Bolivia 510; Uruguay 20.

See footnotes at end of table.

Table 2.—Argentina: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Boron materials:				
Crude natural borates	7,412	12,682	--	Brazil 12,376; Uruguay 306.
Oxides and acids	4,434	6,912	--	Brazil 5,857; Netherlands 332; Republic of South Africa 180.
Cement	85,925	48,727	--	Chile 14,479; Bolivia 12,488; India 10,625.
Chalk	15	--		
Clays, crude	14,512	19,310	--	Brazil 12,791; Venezuela 3,000; Chile 1,890.
Diatomite and other infusorial earth	44	42	--	All to Uruguay.
Feldspar, fluorspar, related materials:				
Fluorspar	113	--		
Unspecified	5	93	--	Chile 73; Uruguay 20.
Fertilizer materials: Manufactured:				
Ammonia	195	397	--	Uruguay 393; Peru 3; Paraguay 1.
Nitrogenous	12,527	3,279	--	Uruguay 3,185; Bolivia 49; Paraguay 45.
Phosphatic	--	20	--	All to Brazil.
Potassic	50	6	--	All to Bolivia.
Unspecified and mixed	103	940	--	Bolivia 910; Brazil 30.
Graphite, natural	12	--		
Gypsum and plaster	8,676	10,065	--	Paraguay 9,034; Uruguay 1,025; Ecuador 5.
Lime	3,883	8,216	--	Chile 7,805; Bolivia 338; Guyana 73.
Magnesite, crude	--	26	--	Chile 25; Bolivia 1.
Mica: Crude including splittings and waste	18	43	--	Chile 17; Paraguay 12; Cuba 11.
Pigments, mineral: Iron oxides and hydroxides, processed	132	121	--	Uruguay 78; Colombia 22; Bolivia 9.
Precious and semiprecious stones other than diamond, natural				
value, thousands	$180	$152	$3	West Germany $96; Japan $21; Hong Kong $19.
Salt and brine	7,718	12,738	--	Brazil 9,000; Paraguay 3,368; Uruguay 370.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	25	100	--	All to Paraguay.
Sulfate, manufactured	140	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	3,113	2,406	126	Japan 1,247; Italy 471; Spain 277.
Worked	753	1,940	1,107	New Zealand 268; Canada 164.
Dolomite, chiefly refractory-grade	1,008	473	--	All to Chile.
Gravel and crushed rock	42	13	--	Paraguay 8; Uruguay 5.
Quartz and quartzite	12	2	--	All to Paraguay.
Sand other than metal-bearing	7	20	--	All to Uruguay.
Sulfur:				
Elemental, crude including native and byproduct	353	41	--	Paraguay 30; Uruguay 11.
Sulfuric acid	278	2,955	2,950	Bolivia 5.
Talc, steatite, soapstone, pyrophyllite	51	98	--	Chile 95; Paraguay 3.
Other:				
Crude	7,332	9,375	--	All to Brazil.
Slag and dross, not metal-bearing	150	86	--	France 76; West Germany 10.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	676	513	--	Chile 410; Brazil 75; Paraguay 28.
Carbon black	169,825	153,056	--	Brazil 67,022; U.S.S.R. 52,831; Iran 26,813.
Coal: All grades excluding briquets	(2)	3	--	All to Uruguay.
Coke and semicoke	54,654	82,707	--	Belgium-Luxembourg 61,278; Netherlands 21,427; Uruguay 2.
Peat including briquets and litter	--	13	--	All to Uruguay.

See footnotes at end of table.

Table 2.—Argentina: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Destinations, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude thousand 42-gallon barrels	2,926	948	432	Uruguay 363; Paraguay 153.
Refinery products:				
Liquefied petroleum gas do	264	234	--	Paraguay 200; Brazil 34.
Gasoline, motor do	3,249	674	6	Brazil 391; Uruguay 135; Paraguay 108.
Mineral jelly and wax do	52	55	--	Chile 29; Peru 20; Uruguay 4.
Kerosene and jet fuel do	522	149	--	Paraguay 76; Brazil 73.
Distillate fuel oil do	4,644	1,320	(2)	Paraguay 850; Brazil 446; U.S.S.R. 22.
Lubricants do	16	81	2	Uruguay 55; Paraguay 19.
Residual fuel oil do	12,496	4,743	4,710	Paraguay 20; Japan 7.
Bitumen and other residues do	67	78	--	Paraguay 46; Chile 25; Bolivia 6.
Bituminous mixtures do	8	3	--	Mainly to Paraguay.
Petroleum coke do	1,208	555	101	Netherlands 172; Canada 169; Denmark 110.

[r]Revised. NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and rare-earth metals	15	21	9	France 6; Brazil 5.
Aluminum:				
Ore and concentrate	23,665	25,739	--	China 17,200; Brazil 7,965; Italy 520.
Oxides and hydroxides	303,303	356,839	700	Australia 343,924; Brazil 9,751; Belgium-Luxembourg 906.
Metal including alloys:				
Unwrought	16	11	(2)	Mainly from Brazil.
Semimanufactures	816	1,108	72	Italy 269; Brazil 235; France 135.
Antimony: Oxides[3]	--	1	NA	NA.
Cadmium: Oxides and hydroxides[3]	33	64	NA	NA.
Chromium:				
Ore and concentrate	18,281	15,572	--	Republic of South Africa 13,568; Cuba 2,004.
Oxides and hydroxides value, thousands	--	$1	$1	
Cobalt: Oxides and hydroxides	11	11	7	Belgium-Luxembourg 4.
Columbium and tantalum: Metal including alloys, all forms, tantalum value, thousands	$40	$22	$12	West Germany $10.
Copper:				
Oxides and hydroxides[3]	4	1	NA	NA.
Metal including alloys:				
Scrap	37	80	--	All from Chile.
Unwrought	28,053	48,222	4	Chile 45,732; Peru 2,455; Canada 16.
Semimanufactures	902	1,042	102	Japan 385; West Germany 248; Brazil 171.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	2,455	3,128	--	Brazil 2,909; Peru 273.
Pyrite, roasted	--	5,567	--	All from Brazil.
Metal:				
Scrap	645	1,068	--	Brazil 751; Japan 148; West Germany 86.
Pig iron, cast iron, related materials	32,947	1,470	819	Brazil 382; Canada 128.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Ferroalloys:				
Ferromanganese	2,272	1,302	--	Brazil 768; Republic of South Africa 356; Sweden 160.
Unspecified	2,422	2,536	113	Republic of South Africa 755; Brazil 660; Netherlands 350.
Steel, primary forms	323,350	421,094	2	Italy 123,370; Japan 81,459; Brazil 71,070.
Semimanufactures:				
Bars, rods, angles, shapes, sections	15,837	17,277	172	Uruguay 6,556; Belgium-Luxembourg 4,451; Brazil 2,617.
Universals, plates, sheets	96,216	97,045	8,548	Brazil 24,288; Spain 12,762; West Germany 12,275.
Hoop and strip	2,937	4,153	261	Belgium-Luxembourg 1,566; Brazil 570; West Germany 382.
Rails and accessories	356	437	85	Belgium-Luxembourg 195; West Germany 112.
Wire	3,264	4,528	20	Uruguay 3,133; Brazil 568; Japan 220.
Tubes, pipes, fittings	17,784	8,290	334	Japan 2,730; Sweden 1,777; Brazil 988.
Castings and forgings, rough	85	33	3	Brazil 15; West Germany 9; Spain 4.
Lead:				
Oxides	120	--		
Metal including alloys:				
Unwrought	(2)	10	--	All from Belgium-Luxembourg.
Semimanufactures	22	3	--	Bolivia 2; West Germany 1.
Lithium: Oxides and hydroxides[3]	36	170	NA	NA.
Magnesium: Metal including alloys:				
Unwrought	268	840	398	Norway 258; Italy 150.
Semimanufactures	11	63	61	West Germany 2.
Manganese:				
Ore and concentrate	64,000	50,578	83	Brazil 50,426; Belgium-Luxembourg 54.
Oxides	499	790	21	Brazil 614; Belgium-Luxembourg 127; Republic of South Africa 28.
Mercury 76-pound flasks	1,334	6,150	406	Spain 4,786; Mexico 754.
Molybdenum: Metal including alloys, all forms	2	5	3	France 1.
Nickel:				
Matte and speiss	1	29	--	All from Cuba.
Oxides and hydroxides[3]	27	110	NA	NA.
Metal including alloys:				
Unwrought	329	538	310	Norway 114; Canada 38.
Semimanufactures	175	150	18	West Germany 68; Netherlands 21.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, platinum value, thousands	$511	$532	--	Spain $385; West Germany $94; Canada $45.
Silver: Metal including alloys, unwrought and partly wrought do.	$2,699	$2,924	$19	Peru $2,288; Belgium-Luxembourg $485; West Germany $116.
Tin:				
Ore and concentrate	--	131	--	Mainly from Bolivia.
Metal including alloys:				
Unwrought	469	1,344	(2)	Brazil 1,256; Bolivia 68; Netherlands 20.
Semimanufactures	8	15	13	West Germany 1; Republic of Korea 1.
Titanium: Oxides	543	1,037	14	Belgium-Luxembourg 331; West Germany 325; Netherlands 116.
Tungsten:				
Ore and concentrate	21	10	--	All from Bolivia.
Metal including alloys, all forms	19	30	3	West Germany 25; Brazil 1.
Zinc:				
Oxides	80	35	4	Uruguay 28; West Germany 3.
Metal including alloys:				
Unwrought	60	4,457	--	Peru 2,939; Netherlands 769; Mexico 749.
Semimanufactures	62	77	(2)	Mainly from Mexico.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Other:				
Ores and concentrates	860	2,541	3	Republic of South Africa 2,001; Bolivia 390.
Oxides and hydroxides	38	57	5	West Germany 33; Italy 6.
Base metals including alloys, all forms	231	234	120	Republic of South Africa 32; Peru 30.
INDUSTRIAL MINERALS				
Abrasives n.e.s.:				
Natural: Corundum, emery, pumice, etc	109	185	185	
Artificial: Corundum	4,196	6,931	35	Brazil 6,387; West Germany 250; France 228.
Dust and powder of precious and semiprecious stones value, thousands	$429	$558	$537	Belgium-Luxembourg $21.
Grinding and polishing wheels and stones	111	188	5	Italy 83; Brazil 45; West Germany 45.
Asbestos, crude	5,863	12,701	121	Canada 4,788; Brazil 4,741; Republic of South Africa 2,790.
Barite and witherite	1,404	259	36	Bolivia 210; Belgium-Luxembourg 10.
Boron materials: Oxides and acids	19	--		
Bromine[3]	20	19	NA	NA.
Cement	738	1,048	--	France 652; Netherlands 183; Yugoslavia 155.
Chalk	--	2	--	All from West Germany.
Clays, crude	16,710	25,056	15,818	Brazil 8,732; Netherlands 299.
Cryolite and chiolite	3	11	--	Denmark 10; Belgium-Luxembourg 1.
Diamond:				
Gem, not set or strung value, thousands	--	$2	$2	
Industrial stones do	$382	$375	$109	Belgium-Luxembourg $226; Switzerland $34.
Diatomite and other infusorial earth	2,033	2,300	116	Mexico 1,618; Chile 560.
Feldspar, fluorspar, related materials	1,000	--		
Fertilizer materials:				
Crude, n.e.s	r5	15	--	Brazil 14; France 1.
Manufactured:				
Nitrogenous	130,552	49,165	17,574	Bulgaria 12,998; Venezuela 8,064.
Phosphatic	36,983	29,348	10,074	Israel 15,523; Uruguay 3,480.
Potassic	9,991	19,518	11,746	Israel 4,980; Brazil 2,411.
Unspecified and mixed	52,312	93,894	85,057	Brazil 5,835; Chile 2,440.
Graphite, natural	183	392	49	Brazil 207; West Germany 81.
Gypsum and plaster	9	11	5	Italy 3; Japan 3.
Iodine[3]	19	20	NA	NA.
Lime	--	105	--	All from Uruguay.
Magnesite, crude	19,926	15,812	60	Brazil 9,110; Mexico 5,963; Italy 300.
Mica:				
Crude including splittings and waste	46	2	2	
Worked including agglomerated splittings	10	6	2	Spain 2; France 1.
Nitrates, crude	2,210	2,575	--	All from Chile.
Pigments, mineral: Iron oxides and hydroxides, processed	74	68	46	West Germany 13; Belgium-Luxembourg 9.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$17	$44	$18	Brazil $26.
Synthetic do	$49	$8	$8	
Pyrite, unroasted	25	3	--	All from West Germany.
Salt and brine	20	44	10	West Germany 18; Belgium-Luxembourg 12.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sodium compounds, n.e.s.:				
Carbonate, natural and manufactured	124,116	197,847	84,882	Belgium-Luxembourg 32,465; Romania 20,813.
Sulfate, natural and manufactured[3]	2,794	4,396	NA	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	519	3,347	--	Brazil 3,174; Uruguay 111; Italy 61.
Worked	109	575	--	Spain 278; Italy 195; Uruguay 72.
Dolomite, chiefly refractory-grade	536	463	--	Brazil 412; Spain 50; Italy 1.
Gravel and crushed rock	11,810	71,415	--	Uruguay 52,393; Paraguay 19,000; Belgium-Luxembourg 12.
Quartz and quartzite	242	127	--	Sweden 51; Belgium-Luxembourg 42; West Germany 34.
Sand other than metal-bearing value, thousands	$1,084	$627	$92	Uruguay $392; Brazil $142.
Sulfur:				
Elemental:				
Crude including native and byproduct	35,473	110,571	11,979	Canada 98,592.
Colloidal, precipitated, sublimed	39	23	21	West Germany 2.
Sulfuric acid	2,496	5,174	--	Uruguay 5,173; Italy 1.
Talc, steatite, soapstone, pyrophyllite	451	382	14	China 224; Uruguay 60; Brazil 41.
Other:				
Crude	3,886	5,609	436	Brazil 2,616; Republic of South Africa 877; West Germany 740.
Slag and dross, not metal-bearing	505	365	--	Brazil 340; Uruguay 20.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	87	133	133	
Carbon black	1,149	767	219	Belgium-Luxembourg 330; West Germany 112.
Coal:				
Anthracite and bituminous excluding briquets	763,838	1,091,564	707,552	Poland 289,342; Australia 65,034.
Lignite including briquets	100	100	100	
Coke and semicoke	2	--	--	
Gas, natural million cubic feet	78,080	78,204	--	All from Bolivia.
Peat excluding briquets[3]	6	20	NA	NA.
Petroleum:				
Crude 42-gallon barrels	7	7	7	
Refinery products:				
Liquefied petroleum gas do.	208,406	12	12	
Gasoline do.	833	6,621	1,479	Netherlands 4,471; West Germany 442.
Mineral jelly and wax do.	4,407	6,390	1,629	Brazil 3,054; Spain 929.
Kerosene and jet fuel do.	390,670	39	39	
Lubricants do.	51,359	28,553	18,459	West Germany 4,361; Japan 2,002.
Bituminous mixtures do.	127	61	--	All from West Germany.
Petroleum coke do.	33	28	28	

[r]Revised. NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Estadistica Minera de la Republica Argentina, 1987.

COMMODITY REVIEW

METALS

Aluminum.—ALUAR's refinery in Puerto Madryn, Chubut Province, is 52.1% owned by the state and 47.9% by private investors. ALUAR receives 320,000 tons of alumina per year as part of a 20-year contract with Alcoa of Australia. Petroleum coke for its carbon anodes comes from the domestic refinery in Ensenada, where quality is reported to be very high: only 0.4 parts per million of sulfur. ALUAR also receives asphalt for its carbon anodes from the Federal Republic of Germany.

Since 1975, the Argentine aluminum industry has been vertically integrated, from the production of primary aluminum to aluminum mill products. ALUAR's refinery came on-stream that year with a production capacity of 140,000 tons per year. In 1986, capacity was expanded to 150,000 tons per year. ALUAR provided all aluminum ingots to the domestic industry, and it was investing $60 million to expand production to 165,000 tons per year by 1989. With the purchase of Kicsa from Kaiser Aluminum Co. and the association with Camea S.A. and Filpa S.A., Argentina became a net exporter of aluminum ingots and aluminum products. In 1987, ALUAR produced 155,000 tons of aluminum, 50% of which was consumed domestically and 50% was exported.

ALUAR has shifted part of its electric energy requirements from hydroelectric to thermal power generated by its own gas turbines. This has reduced its consumption of electricity generated by the Futaleufu powerplant from 90% to 63% of the total.

Copper.—The Provincial government of Mendoza was planning to auction the Paramillos Sur copper-gold-molybdenum deposit 75 kilometers north of the city of Mendoza. The prospect consists of nine mining concessions of 100 hectares each.

The Paramillos Sur deposit, owned by the Provincial government, is a disseminated porphyry copper about 100 meters below the surface, partly covered by alluvial sediments and leached rocks. It was discovered in 1964-68 by the United Nations Revolving Fund for Natural Resources and the Provincial government under the Plan Cordillerano exploration program. Results show the presence of 186 million tons of ore grading 0.58% copper and 0.01% to 0.05% molybdenum with 0.06 to 0.42 gram of gold per ton.

Under the terms of the auction, the investor would receive the concession to exploit the deposit under the mining code of Argentina. The code provides for a 2% royalty to the Provincial government only when the mine is in production.

Gold and Silver.—The Farallón Negro gold, silver, and manganese mine, located at Belén, Catamarca Province, is Argentina's largest gold producer, with output of 17,360 troy ounces of gold and 84,900 ounces of silver per year. The property is an underground mine originally oriented toward manganese production. The ore contains manganese oxide with finely disseminated gold in quartz veins. The ore contains an average of 0.2 ounce per ton of gold, 3.2 ounces per ton of silver, and 10% manganese. The owner of the mining district, YMAD, is a state enterprise controlled by the Provincial governments of Catamarca and Tucumán. The district, in addition to Farallón Negro, includes the Bajo de la Alumbrera copper-gold-silver-molybdenum deposit and the Alto de la Blenda lead-zinc-silver deposit. Several foreign countries have assisted YMAD in evaluating ore reserves via grants or concessionary loans. The Japanese International Cooperation Agency (JICA) through a $1.5 million grant assisted YMAD in the exploration of the Alto de La Blenda deposit. That deposit, under development, is only 31 miles from the Farallón Negro Mine, but it has different ore composed of a lead-zinc sulfide with higher silver values. Reserves found in this deposit reportedly are sufficient for several years of operation.

YMAD built a 9,000-square-meter heap-leaching pad at the Farallón Negro Mine to process low-grade ores, previously discarded as waste, at a rate of 4,500 tons per month. Tests show that recovery rates would be 65% for gold and 20% for silver after 30 days of leaching. This facility provided about 11% of the total gold and silver production of the mine.

The Bajo de la Alumbrera polymetallic deposit is 4 miles to the southeast of Farallón Negro and has an estimated 340 million tons (on the basis of a cutoff grade of 0.2% copper) of sulfide ore with an average of 0.49% copper, 0.007% molybdenum, and 0.52 gram of gold per ton. Feasibility studies completed in 1984 indicated that the mining would be at a rate of 37,000 tons per day. The total cost of the project would be about $700 million, but the depressed price of copper discouraged would-be investors. However, YMAD continued to study the deposit and began heap leaching to recover gold on a pilot basis using the facilities at Farallón Negro. Negotiations with the Federal Republic of Germany were successful in getting a $13 million loan to finance the exploitation of the upper layer of the Bajo de la Alumbrera deposit by heap leaching. The West German Reconstruction Bank granted a long-term, low-interest loan for this project and retained the Otto gold consulting firm for technical assistance to YMAD. It was expected that this limited approach would increase YMAD's production of gold fourfold by the early 1990's, making Catamarca Province the largest

gold-producing area in the country.

Iron Ore.—The Sierra Grande deposits, which were being developed by HIPASAM, are Argentina's largest and most important iron ore resources. Along with Sociedad Mixta Siderúrgica Argentina S.A. (SOMISA) steel complex, HIPASAM was expected to make Argentina self-sufficient in iron and steel production. As part of this overall plan, HIPASAM was originally to produce 2 million tons of iron ore pellets per year at Sierra Grande. All of this output was to be transported to SOMISA's steel complex in San Nicolás, Buenos Aires Province, 1,400 kilometers away. Owing to subsequent government changes, financial problems, and associated shortfalls in planned investment, HIPASAM was "overdimensioned" in its pellet plant. Although its concentration and pelletizing capacity was 2 million tons per year, its mine could provide only 2 million tons of iron ore, or the pellet equivalent of 1 million tons per year. In 1986, pellet production was only 650,000 tons. From January to April 1987, pellet production actually stopped, forcing the Government to intervene in the workers' strike. During this period, production was reduced to 40,000 tons per month and the quality of product was so poor it could not be shipped to the steel plant. Pellet production thereafter increased to 80,000 tons per month.

The Sierra Grande Mine is composed of three separate ore bodies: Yacimiento Sur, currently under production; Yacimiento Este; and Yacimiento Norte. Sierra Grande's estimated reserves are 500 million tons of iron ore of which 113 million tons are measured reserves at Yacimiento Sur. The ore is composed of iron (54.8%), silicon (6.0%), alumina (4.9%), calcium (3.3%), phosphorus (1.4%), sulfur (0.4%), and other minerals (29.2%).

Iron ore deposits in Misiones Province were under study. The mineralization occurs in a narrow belt parallel to the Paraná River, where 30 million tons of iron ore have been measured. The mineralized beds have an average thickness of 1.2 meters and are composed of hematite, limonite, and geothite grading between 28% and 40% Fe. The iron ore is easily reduced because it has no phosphorus, sulfur, or other undesirable elements. It is suitable for the production of high-quality pig iron and special steels.

Iron and Steel.—Crude steel production increased for the third consecutive year to just over 3.6 million tons, a 12.3% increase. The output of hot-rolled steel products maintained the same level as that of 1986.

In 1987, SOMISA, Argentina's largest state-owned steel producer, received 70% of its iron ore pellet requirements, or 22% of its total iron requirements from HIPASAM's Sierra Grande iron ore mine. The rest of SOMISA's iron ore and pellet requirements was imported from Brazil and Venezuela. Iron ore from Brazil also included sinter feed. SOMISA imported metallurgical coal to process in its own coke plant, mainly from the United States, but also from Australia, Poland, and to a lesser extent from Canada and Colombia. In addition, SOMISA imported manganese and tinplate from Brazil. Limestone, dolomite, fluorspar, ferroalloys, and aluminum scrap were supplied from domestic sources.

SOMISA has the capacity to produce 2.7 million tons of steel per year, but actual production in 1987 was only 1.8 million tons. SOMISA had been forced by the state to increase its steel billet capacity to meet the needs of Industria Argentina de Aceros S.A. (ACINDAR), the largest private steelmaker in the country, but ACINDAR was granted authority to produce its own steel billets. This situation left SOMISA with an expanded capacity for steel billets and a contracted domestic market. Later, ACINDAR purchased three smaller domestic steel companies, Gurmendi S.A. in Buenos Aires (which was closed down), Santa Rosa S.A. in Buenos Aires, and Navarro S.A. in Rosario, all of which then used ACINDAR's billets. Consequently, SOMISA, instead of supplying domestic customers with 1.0 million tons of steel billets per year, was supplying only 250,000 tons to a reduced number of smaller domestic customers. SOMISA's major export market in 1987 was the United States, followed by Japan, Thailand, and Taiwan. The decline in economic activity in the second half of the year caused a reduced demand for steel.

The Ministry of Economy announced a number of measures to deregulate steel and other industries and to expose them to open competition. Restrictions on iron and steel imports were to be ended and replaced with a 20% ad valorem duty on the f.o.b. price. The measures did not include the lifting of controls on domestic steel prices.

Manganese.—The Córdoba government in late November inaugurated a manganese processing plant at Pozo Nuevo, 230 kilometers north of Córdoba, the Provincial capital. The plant was designed to treat 250 tons per day of low-grade ores containing 12% to

15% manganese. The plant feed would come from small mines in Córdoba and Santiago del Estero Provinces to produce a concentrate containing 35% manganese, at a 75% mill recovery rate. The reserves in those small mines was estimated at 800,000 tons. The concentrate was intended for domestic consumption by the steel industry and would reduce Argentina's dependence on imported ore.

Nickel-Cobalt.—The Secretary of Mining invited tenders on exploration and feasibility studies of Las Aguilas nickel-cobalt-copper deposit, in San Luis Province. The deposit belongs to the Dirección General de Fabricaciones Militares (DGFM). Two mineralized areas have been put up for tender, Las Aguilas Oeste and Las Aguilas Este. Proven reserves were estimated at 1.2 million tons, probable reserves at 200,000 tons, and possible reserves at 800,000 tons, with an average grade content of 0.52% nickel, 0.036% cobalt, and 0.50% copper. The minerals produced from these deposits would be readily absorbed by the domestic market.

Tin.—Sociedad Minera Pirquitas-Picchetti y Cía. S.A., the second largest private mining operation in Argentina, after El Aguilar, put the Pirquitas tin mine up for sale through an open bidding process. The 7,000-ton-per-month mine was closed down more than a year earlier because of rising debts. It filed for relief under Argentine bankruptcy laws because of the sharp fall in world tin prices. The mine is on the continuation of the Bolivian tin belt, near the border in Jujuy Province. Since 1982 its low-grade tin concentrate had been shipped to its own Estansa smelter in Palpalá, Jujuy Province.

INDUSTRIAL MINERALS

Lithium.—The Lithium Corp. of America reached a final agreement with the Provincial government of Catamarca and DGFM to explore and develop the Salar del Hombre Muerto lithium carbonate deposit in Catamarca Province, which according to government officials has the potential to produce 5,000 tons of lithium carbonate per year valued at approximately $20 million. This agreement was reached after a long delay because of domestic problems that had deterred previous tenders.

Phosphate.—HIPASAM announced a plan for the construction of an apatite pilot plant in Rio Negro Province to recover phosphates from the tailings of the Sierra Grande iron ore operations. An agreement was signed before yearend between the Secretariat of Economic Promotion and the HIPASAM officials. The iron ore production of Sierra Grande contains 1% apatite, or calcium phosphate, from which the phosphorus will be extracted. The second phase of the project is to produce fertilizers from this concentrate for domestic consumption, and the third phase would concern the production of elementary metallic phosphorus using an electric furnace.

Potassium Salts.—The joint venture between Texas Gulf Inc. of the United States and Empresa Minera Tea S.A. of Argentina continued its exploration of the potash deposit discovered by YPF while drilling for oil in 1986. The potash deposit occurs along the Rio Colorado in Mendoza Province. The joint-venture proposal calls for a production of 1 million tons of potassium chloride per year with lesser amounts of potassium sulfate and potassium nitrate.

Another small-scale project by an Argentine company was scheduled to initiate construction of an $8 million chemical plant to process lithium, magnesium, and potassium salts from the El Salar del Rincon, near Campo Quijano in the Province of Salta. Production of an estimated 6,000 tons of potassium chloride and potassium sulfate per year was scheduled by yearend, as well as 800 tons per year of lithium carbonate for late 1988. Potassium salts would be marketed domestically for the fertilizer and explosives industries and lithium carbonate for the nuclear energy, glass, and lubricants plants.

Sulfur.—The Provincial government of Salta was continuing its efforts to reactivate La Casualidad sulfur mine. Production was suspended when operating costs reached $100 per ton while imported sulfur was $60 per ton. Technical studies on the deposit were carried out by a West German company, but details of the findings were unavailable. The deposit, in the Andean region, has sulfur of volcanic origin. Any future production from the deposit would replace a part of Argentina's sulfur imports of about 100,000 tons per year. Through international bidding, Empresa Minera Unificada S.A. of Bolivia (EMUSA) acquired 90% ownership of La Casualidad. Plans call for an output of 30,000 tons per year.

MINERAL FUELS

Coal.—YCF's Rio Turbio coal mine is Argentina's largest underground mine for the production of subbituminous Type A

coal. The mine is in the southwest corner of Santa Cruz Province, 16 kilometers east of Puerto Natales, Chile.

A 5-year exploration of Argentina's coal reserves in the Patagonia region was completed in August 1987. Findings indicate 5.2 billion tons of probable steam coal reserves in the Brazo Sur of the Rio Coyle. This is in addition to 700 million tons of probable reserves and 182 million tons of proven reserves in the Rio Turbio region. In 1987, the Rio Turbio Mine produced 525,000 tons of steam coal, 17% more than in 1986. Under an 8-year program, YCF planned to increase annual production to 650,000 tons by 1988 and 1.6 million tons by 1992. In 1987, Argentina imported 160,000 tons of steam coal to satisfy domestic demand. According to YCF officials, there are sufficient infrastructure and commercially exploitable reserves to reach the 1.6-million-ton goal, but there is a shortage of mining equipment.

Rio Turbio Mine's principal customers were the electric power services of greater Buenos Aires and the Water and Electric Power Authority's thermal powerplant in San Nicolás, Rosario Province. Domestic steam coal consumption in 1987 was approximately 850,000 tons. An important future customer would be the new powerplant planned for Bahía Blanca, which would consume the equivalent of 1.5 million tons of steam coal per year. YCF is also responsible for marketing all the petroleum coke produced in Argentina.

Natural Gas.—Natural gas production declined slightly. Argentina imported almost 74.9 billion cubic feet of natural gas from Bolivia, 4.2% less than in 1986, for a total value of $291.4 million, 11.3% less than in 1986.

Natural gas was imported under a bilateral agreement between Argentina and Bolivia. The two countries renegotiated the contract terms in September 1987, arriving at a price of $3.05 per British thermal unit for gas purchased through 1987 with an indexed price to be used thereafter. The bilateral supply contract was due to expire in 1992.

Of the total production of natural gas during the year, 16% was used by home consumers, 15% in thermoelectric plants, 32% in industrial plants (including petrochemical plants), 4% was consumed at the production site, 14% was flared, 8% was reinjected into the reservoirs for repressuring, and 11% represented losses. Argentina's natural gas distribution network is extensive, with a total length of 10,000 kilometers in four main pipelines, but nonetheless is not adequate to satisfy distribution needs. A large pipeline project was under construction from gasfields in Neuquén to the eastern port city of Bahía Blanca (a petrochemical center) to ease the distribution problem. The pipeline was being constructed with Mexican financing and was scheduled to come on-stream in mid-1988. Several private, both domestic and foreign, companies have put forth proposals to increase the transmission capacity of existing pipelines. Gas del Estado, the state-owned gas company, was studying some major projects required to increase natural gas production and processing; other projects concern construction of regional pipelines to provide natural gas to several provinces without access to natural gas.

Petroleum.—Crude oil production in Argentina continued a downtrend that began in 1980. Production in 1987 declined slightly to just over 156 million barrels. Private companies, both domestic and foreign, operated oil and natural gas concessions under contract with the state. In general, private companies were required to obtain state approval to explore and extract mineral resources and must do so within areas designated by the state. Private companies were also required to sell the resources extracted to the state at established prices. In 1985, Argentina launched a program to stimulate private investment and increase hydrocarbon production. The so-called Houston Plan offered specific areas of the country for oil and gas exploration in a series of rounds of bids. Although the areas offered included some geologically attractive areas, the first two rounds brought few bids, primarily because of the restrictive nature of the model contract applied to the private concessions. A more successful outcome was expected for the third round of bids to be opened by yearend, which offered a more flexible model contract as well as improved payment compliance by YPF. The Argentine Government was also developing a short-term energy plan called Plan Olivos I to stimulate petroleum production for existing fields.

Ninety-eight potential areas were put up for bids during the three bidding rounds. The 30 areas offered in the third round covered an area of about 234,000 hectares, and were in five different basins.

The majority of the areas with hydrocar-

bon potential in the country, however, were reserved for exploration and extraction by YPF. Although these areas reportedly have great potential, YPF has been unable to maximize its opportunities due to problems of management and lack of long-range planning. YPF has also been handicapped by budget constraints that severely limited its ability to expand or maintain existing operations.

Uranium.—Production of uranium concentrate increased modestly to an estimated 180 tons. Argentina's well-developed nuclear energy program was affected by the country's economic austerity. Latin America's largest nuclear energy program, now managed by civilians, was split over funding and size, and whether to seek foreign capital by privatizing some key elements of the program. Uncertainties in the program caused the departure of technical personnel.

Despite a loan from the Federal Republic of Germany to help complete the Atucha II nuclear energy power station in Greater Buenos Aires, the project continued to run behind schedule and lacked sufficient funding. Kraftwerk Union, a West German firm, held a minority interest in the state-owned company that designs and supervises construction of nuclear facilities. The Arroyito heavy water plant in Neuquen Province, another project moving slowly because of lack of funds, was being built with Franco-Swiss expertise acquired from Sulzer Bros., a Swiss company. Complicating matters, Argentina observed a double-faceted policy on nuclear safeguards and inspections. Although Argentina safeguarded its nuclear exports through the International Atomic Energy Agency (IAEC) in Vienna, Austria, it was unwilling to allow inspection of its own facilities. This policy sought to protect Argentina's nuclear technology. Despite some continuing differences, the nuclear dialogue between the U.S. Government and Buenos Aires was improving. The Argentine decision to allow the safeguarding of exports through the IAEC was viewed as a very positive step in the U.S. Government.

Argentina continued efforts to market its nuclear technology to developing nations. To keep the export program alive, the Government rescheduled some outstanding loans to Peru, enabling work on the Guarangal nuclear reactor outside Lima to continue. Algeria, Albania, Morocco, and Iran were other potential customers for Argentina's nuclear technology and uranium supply. A nuclear cooperation agreement was signed in November 1986 between the Comisión Nacional de Energía Atómica (CNEA) and the Cuban Atomic Energy Commission. In September 1987, Argentina and Brazil entered into an agreement to collaborate on nuclear projects.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Argentine australes to U.S. dollars at the rate of australes2.31=US$1.00, the average exchange rate in 1987.

The Mineral Industry of Australia

By Travis Q. Lyday[1]

The Australian minerals industry covered just about the whole spectrum of minerals, from major industrial minerals (ilmenite, rutile, and zircon), base metals (copper, lead, and zinc), ferrous metals (iron ore and manganese), nonferrous metals (aluminum and nickel), precious metals (gold and silver), fuel minerals (coal and uranium), to gem stones (diamond, opal, and sapphire). Australia was one of the world's principal producers and suppliers of ores, concentrates, and refined metals. The notable minerals, either missing from the Australian mining scene or produced in minor amounts, were fertilizer materials (phosphate rock and potassium fertilizer), chromium, and mercury. The minerals industry was the largest primary sector contributor, generating an estimated 10% of the country's gross domestic product (GDP).

Australia was the seventh largest producer of coal (all grades) in the world, ranking behind China, the United States, the U.S.S.R., the German Democratic Republic, Poland, and the Federal Republic of Germany and was the world's largest coal exporter. It was the largest producer of bauxite and alumina; ilmenite, rutile, and zircon; and diamond, opal, and sapphire. It was the second largest producer of iron ore, after Brazil, and the fifth largest gold producer, after the Republic of South Africa, the Soviet Union, the United States, and Canada. Australia was also a significant producer of copper, lead, tin, uranium, and zinc.

Australia has relied heavily on the export of the majority of its mineral production to bolster economic growth, as the country itself was too small a mineral consumer to use all of the minerals it produces.

Using plentiful resources of coal, liquefied petroleum gas, and uranium, Australia remained one of the few market economy countries to be a net exporter of mineral fuels, enabling the country to retain a favorable trade balance in energy products.

Government Policies and Programs.—The Government announced near yearend that export controls on primary copper, lead, manganese, nickel, and zinc would be removed as soon as the appropriate amendments could be made to the customs regulations. However, export controls will remain on copper scrap and copper-alloy scrap, secondary copper ingots, nickel powder, and, for environmental reasons, mineral sands.

PRODUCTION

The value of minerals produced in Australia in 1985, the latest year for which official data were available, was $15.4 billion,[2] almost 11% of the GDP. Petroleum (crude oil, natural gas, and natural gas liquids) contributed 45% of this total, followed by coal, 24%, and iron ore and concentrate, 9%. Other major contributors included construction materials, 4%; gold bullion, 4%; bauxite, 3%; copper, 2%; nickel, 2%; lead, 1%; uranium, 1%; and zinc, 1%. These were followed, in descending order, by lignite, manganese, salt, tin, rutile, ilmenite, diamond, zircon, opal, clays, limestone, silica, and tungsten.

The increase in the value of mineral products in 1985 was 28%, facilitated by the devaluation of the Australian dollar by

about 25% against major world currencies. The value of most major mineral commodities improved over the 1984 values, the largest increases being gold bullion, 65%; rutile, 60%; copper, 43%; petroleum, 35%; coal, 31%; nickel, 27%; iron ore, 22%; lignite, 21; construction materials, 17%; zinc, 12%; and lead, 7%. Uranium was the only major mineral to decrease markedly in value, falling 28%. Smaller decreases were recorded by limestone, tin, and gypsum.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Bauxite, gross weight ----- thousand tons	24,372	r31,537	31,839	32,384	34,000
Alumina ----- do	r7,231	8,781	8,792	9,423	210,105
Metal, refined:					
Primary	478,190	757,798	851,286	881,910	21,003,947
Secondary	37,700	r43,300	34,100	r e55,000	255,000
Antimony, Sb content of antimony and lead concentrates	538	1,149	1,458	10,064	1,000
Bismuth, mine output, Bi content[e 3 4]	1,410	1,350	1,400	1,000	1,000
Cadmium:					
Mine output, Cd content	2,275	r2,311	2,776	2,260	2,500
Metal, smelter (refined)	1,121	1,082	1,060	870	2888
Cobalt:					
Mine output, analytic content of:					
Nickel ore	1,634	1,551	2,456	2,389	2,500
Nickel concentrate	477	520	508	e500	500
Zinc concentrate	85	54	72	41	50
Total	2,196	2,125	3,036	e2,930	3,050
Recoverable cobalt	1,100	936	1,134	r e1,400	1,450
Columbium-tantalum concentrate, gross weight	117	145	110	88	2159
Copper:					
Mine output, Cu content	261,476	235,671	259,765	249,368	223,000
Metal:					
Smelter:					
Primary	173,619	179,822	167,669	169,622	177,000
Secondary	8,202	8,138	7,687	e8,000	8,500
Refined:					
Primary	168,533	171,180	163,833	163,958	185,000
Secondary	27,388	r26,037	30,506	20,360	25,800
Gold:					
Mine output, Au content ----- troy ounces	983,522	51,295,963	61,881,491	2,413,842	3,472,000
Metal, refined:					
Primary ----- do	953,140	1,189,672	1,743,307	2,642,337	23,738,226
Secondary ----- do	96,774	85,746	e90,000	100,000	100,000
Iron and steel:					
Iron ore:					
Gross weight ----- thousand tons	71,038	94,406	92,859	94,135	100,000
Fe content ----- do	45,298	r58,313	58,045	60,120	63,000
Metal:					
Pig iron ----- do	5,045	5,329	5,607	5,889	25,580
Ferroalloys:[7]					
Ferromanganese	53,463	70,883	70,368	61,000	252,000
Ferrosilicon	18,669	18,313	18,951	e15,000	19,000
Silicomanganese	19,810	31,795	25,669	e23,000	243,000
Total	91,942	120,991	114,988	e99,000	114,000
Steel, crude ----- thousand tons	5,657	6,303	6,578	6,703	6,040
Semimanufactures[e]	5,500	6,000	6,000	6,250	6,000
Lead:					
Mine output, Pb content	480,626	440,620	497,954	447,673	476,000
Metal:					
Primary:					
Bullion, for export	182,593	179,491	183,161	188,403	2197,171
Refined	196,335	198,847	200,147	156,239	2201,317
Total	378,928	378,338	383,308	344,642	398,488
Secondary excluding remelt[e]	27,000	21,500	15,600	r14,800	15,600

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS —Continued					
Manganese ore (metallurgical):					
Gross weight thousand tons	1,370	1,849	2,003	1,649	[2]1,853
Mn content do	684	879	958	785	884
Nickel:					
Mine output, Ni content	76,625	76,923	85,757	76,739	74,500
Metal, smelter (refined Ni and Ni content of oxide)	41,800	38,660	40,807	42,097	[2]45,205
Platinum-group metals:[8]					
Palladium, Pd content troy ounces	[3]14,825	16,815	15,304	13,760	15,800
Platinum, Pt content do	[3]1,759	2,122	3,054	3,697	4,200
Total do	[3]16,584	18,937	18,358	17,457	20,000
Rare-earth metals, monazite concentrate:					
Gross weight	15,141	16,260	18,735	14,822	12,700
Monazite content	14,005	15,101	17,394	8,152	6,700
Silver:					
Mine output, Ag content thousand troy ounces	33,208	31,260	34,914	32,882	[2]32,762
Metal, refined do	10,684	9,476	10,578	10,809	[2]9,948
Tin:					
Mine output, Sn content	[9]9,275	[9]7,939	6,363	8,508	7,500
Metal, refined:					
Primary	2,913	2,899	2,683	1,399	600
Secondary[e]	400	400	400	200	200
Titanium concentrates, gross weight:					
Ilmenite thousand tons	893	1,143	1,419	1,238	1,380
Leucoxene	13,358	32,110	13,809	14,143	12,200
Rutile	163,374	170,424	211,615	215,774	257,000
Tungsten, mine output, W content	2,015	[r]1,709	1,971	1,600	[2]1,150
Uranium, mine output, U content	3,211	4,324	3,206	4,154	[2]3,780
Zinc:					
Mine output, Zn content	699,032	676,532	759,083	662,258	733,000
Metal, smelter:					
Primary	298,451	301,940	288,686	305,654	[2]310,189
Secondary[e]	4,500	4,500	4,500	4,500	4,500
Zirconium concentrates, gross weight	382,005	457,599	501,440	451,824	439,000
INDUSTRIAL MINERALS					
Abrasives, natural:					
Beach pebble	[e]2,300	1,655	972	[e]2,000	2,500
Garnet (sales)	2,657	3,287	5,835	[e]3,500	5,000
Asbestos	3,909	--	--	--	--
Barite	11,752	19,511	22,423	5,818	15,000
Cement, hydraulic thousand tons	4,836	5,463	5,887	5,870	6,000
Clays:					
Bentonite and bentonitic clay	30,026	39,172	29,070	24,942	25,000
Brick clay and shale thousand tons	6,203	7,898	8,434	[e]8,000	8,000
Cement clay and shale[10] do	356	385	[e]400	[e]400	400
Damourite clay (sales)	93	2,164	[e]3,000	[e]2,000	2,000
Fire clay	[r]57,163	[3 10]32,686	[3]39,482	[e]60,000	60,000
Kaolin and ball clay	115,526	[10]218,885	165,827	[e]125,000	150,000
Other[10] thousand tons	2,502	1,847	1,750	[e]2,000	2,000
Diamond:					
Gem thousand carats	3,720	3,415	4,242	13,145	[2]13,650
Industrial do	2,480	2,277	2,828	16,066	[2]16,683
Total do	6,200	5,692	7,070	29,211	[2]30,333
Diatomite	7,921	6,430	7,587	7,860	8,000
Feldspar including nepheline syenite	4,244	3,898	6,704	10,456	11,000
Gem stones, other than diamond:					
Opal value, thousands	$40,035	$35,358	$32,305	$36,914	$43,500
Sapphire do	$12,036	$7,846	$5,342	$8,359	$13,500
Other do	$3,307	$3,196	$3,326	$2,316	$2,500
Total do	$55,378	$46,400	$40,973	$47,589	$59,500
Gypsum thousand tons	1,510	1,931	1,744	1,569	1,600
Kyanite[11]	445	1,255	650	1,500	1,500
Lime[3]	1,016,361	1,101,000	1,203,000	[e]1,100,000	1,100,000
Magnesite	20,534	67,041	57,535	38,996	50,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Nitrogen: N content of ammonia	385,000	375,600	404,500	340,000	[2]413,400
Perlite, crude	2,856	3,708	[r e]2,740	[e]3,000	3,500
Phosphate rock	4,868	15,345	33,116	33,659	[2]10,000
Salt thousand tons	5,170	5,695	5,835	[e]6,200	6,200
Sillimanite[12]	121	507	650	133	500
Sodium compounds, n.e.s.: Sodium carbonate[e] thousand tons	300	300	300	300	300
Spodumene, concentrate[3]	1,000	6,500	11,200	[e]11,000	16,000
Stone, sand and gravel:					
Construction sand[10] thousand tons	23,543	24,675	26,640	[e]25,000	25,000
Gravel[10] do.	13,931	15,031	18,393	[e]15,000	15,000
Dolomite do.	585	595	623	[e]600	600
Limestone:[e]					
For cement do.	8,500	9,000	10,000	10,000	10,000
For other uses do.	3,800	4,000	5,000	5,000	5,000
Silica in the form of quartz, quartzite, glass sand do.	1,928	2,242	2,091	[e]2,000	2,000
Other:					
Crushed and broken stone do.	49,115	56,331	67,474	[e]50,000	60,000
Dimension stone do.	97	[r]102	167	[e]100	150
Unspecified do.	25,869	[r]28,986	33,808	[e]25,000	30,000
Sulfur: Byproduct:					
Metallurgy	170,000	190,000	435,313	433,161	435,000
Petroleum	12,897	[r]13,058	11,718	10,200	[2]8,500
Total	182,897	[r]203,058	447,031	443,361	443,500
Talc, chlorite, pyrophyllite, steatite	176,578	186,760	139,391	188,040	175,000
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Bituminous and subbituminous thousand tons	120,482	139,094	158,256	170,031	175,500
Lignite do.	[r]34,120	[r]34,756	37,320	37,617	38,000
Total do.	[r]154,602	[r]173,850	195,576	207,648	213,500
Coke, metallurgical do.	3,374	3,606	3,610	3,523	3,500
Fuel briquets do.	772	810	789	833	1,000
Gas, natural, marketed million cubic feet	420,115	445,966	475,481	519,426	[2]530,543
Natural gas liquids thousand 42-gallon barrels	23,000	21,175	25,939	24,723	[2]24,426
Peat[13]	10,026	[r]14,010	15,707	5,550	14,000
Petroleum:					
Crude thousand 42-gallon barrels	154,417	181,868	209,939	187,196	[2]200,478
Refinery products:					
Gasoline:					
Aviation do.	1,023	1,281	1,177	1,077	[2]1,437
Motor do.	94,214	96,642	99,702	96,456	[2]97,636
Jet fuel do.	14,836	16,452	16,373	17,225	[2]18,387
Kerosene do.	761	812	611	597	[2]382
Distillate fuel oil do.	53,128	55,273	54,673	53,896	[2]58,104
Residual fuel oil do.	19,898	18,086	18,019	13,162	[2]14,031
Lubricants do.	3,324	3,753	3,692	3,358	[2]3,873
Liquefied petroleum gas do.	4,027	4,600	6,069	4,848	[2]4,844
Bitumen do.	2,766	3,171	3,220	3,412	[2]3,157
Unspecified do.	10,879	9,943	7,476	5,716	[2]7,013
Refinery fuel and losses do.	13,433	11,872	11,739	10,976	9,569
Total do.	218,289	221,885	222,751	210,723	218,433

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

[1]Includes data available through Aug. 23, 1988.

[2]Reported figure.

[3]Data are for year ending June 30 of that stated.

[4]Bismuth-rich residues reportedly have been stockpiled owing to weak demand and low prices.

[5]Excludes gold in bismuth concentrate.

[6]Excludes gold in gold ore and concentrate for South Australia.

[7]Data are for year ending Nov. 30 of that stated for plants owned by The Broken Hill Pty. Co. Ltd.

[8]Western Australia only. Platinum-group metals content of nickel ore.

[9]Excludes tin content of copper-tin concentrates.

[10]Excludes production from Western Australia.

[11]Production of kyanite began in 1982 (80 tons) as a byproduct of mineral sands mining at Eneabba, Western Australia.

[12]In addition, about 7,000 tons of sillimanite clay, also known as kaolinized sillimanite, is produced, containing 40% to 48% Al_2O_3.

[13]Excludes data from some States.

TRADE

The value of Australia's mineral exports in 1985, the latest year for which official data were available, rose 34% over that of 1984, setting a record high of $10.4 billion. The volume of exports of all major minerals increased, except for tin and zinc. The largest export earner was coal, which rose 31% in value and represented 34% of the value of total primary mineral exports. Iron ore and pellets remained the second largest export earner, the value increasing 24%. Crude oil exports rose 140% to become the third largest export earner, displacing alumina and aluminum into fourth and fifth places, respectively. Substantial contributions were also made by refined copper, gold, lead, mineral sands, nickel, uranium, and zinc.

The value of imported primary mineral products decreased 2% in 1985 to $1.4 billion, the lowest level since 1979. Crude oil dominated mineral imports, but its value decreased 10% and accounted for 74% of the value of total primary mineral imports. The decrease in crude oil more than offset increases in all other major mineral imports: gold bullion, 131%; elemental sulfur, 46%; ferroalloys, 37%; diamond, 36%; and phosphate rock, 15%. Other significant mineral import items, in order of magnitude, were potassium fertilizers, platinum, asbestos, magnesium, clays, limestone, and magnesite.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides thousand tons	7,158	7,698	NA	Singapore 20; Republic of Korea 8; unspecified 7,669.
Metal including alloys:				
Scrap	19,175	48,022	3,383	Japan 35,736; Republic of Korea 2,602.
Unwrought	564,897	582,509	25,589	Japan 292,620; Republic of Korea 70,881; China 65,484.
Semimanufactures	61,300	58,810	14	Hong Kong 4,809; Singapore 2,054; unspecified 47,451.
Antimony: Ore and concentrate	2,834	1,549	--	Belgium-Luxembourg 894; France 539; Netherlands 115.
Chromium: Ore and concentrate	9	--		
Copper:				
Ore and concentrate	291,158	247,687	2,722	Japan 184,015; Republic of Korea 20,003; Finland 15,385.
Matte and speiss including cement copper	8,001	--		
Metal including alloys:				
Scrap	322	177	--	India 72; United Kingdom 34; Belgium-Luxembourg 29.
Unwrought	73,192	68,421	82	United Kingdom 29,148; Japan 24,747; West Germany 9,165.
Semimanufactures	27,990	13,474	1,230	New Zealand 7,700; Singapore 981; Malaysia 723.
Gold:[2]				
Ores and concentrates, Au content troy ounces	61,761	89,893	NA	NA.
Metal including alloys, unwrought and partly wrought do.	1,541,883	1,796,870	NA	Japan 1,288,214; Hong Kong 188,596; United Kingdom 139,888.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite thousand tons	88,280	82,735	--	Japan 48,554; China 8,709; Republic of Korea 5,274.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal:				
Scrap	503,055	565,535	--	Hong Kong 8,339; New Zealand 1,448; unspecified 550,029.
Pig iron, cast iron, related materials	3,640	26,756	--	Singapore 26,120.
Ferroalloys:				
Ferromanganese	20,055	44,345	12,200	Indonesia 14,641; Qatar 9,118.
Unspecified	55,496	42,189	15,000	Japan 7,150; Belgium-Luxembourg 6,376; Indonesia 3,971.
Steel, primary forms	787,279	514,008	58,266	China 178,990; Iran 99,790; Jordan 42,224.
Semimanufactures:				
Bars, rods, angles, shapes, sections	183,859	202,040	10,049	China 139,031; New Zealand 29,043; Papua New Guinea 13,600.
Universals, plates, sheets	4,697,049	363,389	139,957	New Zealand 40,512; Pakistan 39,298; China 17,854.
Hoop and strip	17,278	16,269	2,497	New Zealand 8,230; Singapore 2,825; Canada 1,326.
Rails and accessories	13,576	1,661	8	Canada 1,414; Indonesia 154.
Wire	311,622	16,598	3,734	New Zealand 3,662; Papua New Guinea 2,226; Hong Kong 1,921.
Tubes, pipes, fittings	33,632	71,836	9	Singapore 1,261; Malaysia 1,131; unspecified 65,888.
Castings and forgings, rough	5,959	18,239	1,399	Papua New Guinea 6,410; Malaysia 4,562; India 1,803.
Lead:				
Ore and concentrate	199,845	230,780	31,849	Japan 60,821; Belgium-Luxembourg 51,236; Sweden 22,565.
Oxides	3,688	3,823	--	Indonesia 492; Singapore 404; unspecified 2,388.
Metal including alloys:				
Scrap	19,903	26,993	80	Republic of Korea 14,864; Philippines 3,564; India 950.
Unwrought	306,254	304,901	--	United Kingdom 155,186; India 41,958; Japan 29,144.
Semimanufactures	2,688	404	--	New Zealand 126; Singapore 99; Philippines 90.
Manganese: Ore and concentrate[2] thousand tons	1,403	1,145	NA	NA.
Nickel:				
Ore and concentrate value, thousands	$9,505	$112	--	Japan $101.
Matte and speiss do.	$231,784	$212,454	--	NA.
Metal including alloys:				
Scrap	600	328	--	United Kingdom 141; Japan 131.
Unwrought and semimanufactures value, thousands	$106,848	$81,551	NA	NA.
Platinum-group metals: Metals including alloys, unwrought and partly wrought do.	$1,245	$2,681	$991	United Kingdom $730; Hong Kong $628.
Rare-earth metals: Monazite concentrate[2]	r18,024	14,100	NA	France 12,725.
Silver:				
Ore and concentrate[3] value, thousands	$21	$5,463	$8	Japan $5,433.
Waste and sweepings[3] do.	$2,557	$3,920	--	United Kingdom $2,743; Japan $1,072.
Metal including alloys, unwrought and partly wrought do.	$39,878	$42,572	--	United Kingdom $22,252; Thailand $3,831; Singapore $3,779.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Tin:				
Ore and concentrate	11,860	15,810	--	Malaysia 14,687.
Metal including alloys:				
Scrap	73	1,381	--	Malaysia 249; unspecified 1,027.
Unwrought	437	229	77	New Zealand 84; Malaysia 36.
Semimanufactures	83	1,392	1,088	New Zealand 139; Hong Kong 80.
Titanium: Ore and concentrate[2] thousand tons	1,380	1,277	537	United Kingdom 234; Japan 180.
Tungsten:				
Ore and concentrate	3,416	2,654	263	West Germany 580; unspecified 1,793.
Metal including alloys, all forms	91	157	1	West Germany 108; Netherlands 38.
Uranium and thorium: Ore and concentrate value, thousands	$226,062	$254,829	$60,386	France $73,028; United Kingdom $46,155; West Germany $43,859.
Zinc:				
Ore and concentrate thousand tons	881	936	6	Japan 525; West Germany 145; Belgium-Luxembourg 100.
Oxides	2,938	510	--	New Zealand 346; China 68; Republic of Korea 40.
Metal including alloys:				
Scrap	903	1,249	--	Republic of Korea 115; unspecified 1,038.
Unwrought	209,807	236,969	40,168	Indonesia 45,823; Hong Kong 16,777; Japan 13,196.
Semimanufactures	9,388	502	--	New Zealand 243; Singapore 84; Fiji 32.
Zirconium: Ore and concentrate[2]	495,891	445,690	34,857	Japan 160,022; Italy 67,061.
Other:				
Ores and concentrates	r20	--		
Oxides and hydroxides	39	--		
Ashes and residues	55,198	854,967	--	United Kingdom 805,960; Japan 17,920.
Base metals including alloys, all forms	855	955	657	Netherlands 68; India 44.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	2,599	2,572	921	Japan 587; Thailand 323; United Kingdom 305.
Artificial: Corundum	2	19	--	New Zealand 17.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$11	$61	$34	United Kingdom $18.
Grinding and polishing wheels and stones	1,722	188	--	New Zealand 137.
Barite and witherite	2,041	1,242	--	New Zealand 1,085.
Cement	(4)	18,490	--	Papua New Guinea 16,090; New Zealand 672.
Clays, crude	8,576	16,615	--	Japan 8,808; Netherlands 2,715; United Kingdom 2,108.
Diamond:				
Gem, not set or strung value, thousands	$21,077	$18,893	$5,503	Belgium-Luxembourg $5,032; Switzerland $1,934.
Industrial stones do	$2,571	$6,852	$148	Switzerland $4,953; New Zealand $280.
Diatomite and other infusorial earth	123	189	--	Philippines 70; New Zealand 39; Papua New Guinea 32.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Fertilizer materials:				
Crude, n.e.s	821	4,937	--	Philippines 2,234; Japan 1,028; Italy 754.
Manufactured:				
Ammonia	65,963	79,283	--	India 32,445; Republic of Korea 16,489; Thailand 5,429.
Nitrogenous	4,175	14,343	--	Singapore 7,165; New Zealand 2,853; Indonesia 2,483.
Phosphatic	158	10,748	10,348	Papua New Guinea 393.
Potassic	30	6	--	Papua New Guinea 2.
Unspecified and mixed	6,084	1,032	--	Papua New Guinea 560; Tonga 119; Samoa 90.
Graphite, natural	72	49	6	New Zealand 43.
Gypsum and plaster	520,840	428,588	25,531	Indonesia 148,737; New Zealand 118,144; Japan 50,358.
Lime	87	233	--	Nauru 121; Vanuatu 65; China 20.
Magnesium compounds: Magnesite, crude	5,445	2,679	40	New Zealand 2,428.
Mica: Worked including agglomerated splittings	(5)	16	(6)	Mainly to Papua New Guinea.
Nitrates, crude	41	9	--	Papua New Guinea 6.
Phosphates, crude	10,034	22,846	1	Japan 15,300; Republic of South Africa 7,500.
Pigments, mineral: Iron oxides and hydroxides, processed	171	167	--	Thailand 55; New Zealand 49; Singapore 34.
Potassium salts, crude	43	--		
Precious and semiprecious stones other than diamond, synthetic value, thousands	$21,087	$27,251	$1,667	Japan $7,785; Thailand $7,747; Hong Kong $5,409.
Salt and brine thousand tons	4,947	5,272	(6)	Japan 3,269; Republic of Korea 778; Brazil 123.
Sodium compounds, n.e.s.: Carbonate, manufactured	2,648	7,207	--	New Zealand 4,464; Fiji 1,550; Singapore 566.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	2,539	5,235	--	Italy 4,835; New Zealand 263.
Worked	287	5	--	New Zealand 4.
Dolomite, chiefly refractory-grade	36	43,555	--	All to Japan.
Gravel and crushed rock	894,993	1,139,464	20	Japan 5,510; Vanuatu 600; unspecified 1,132,914.
Limestone other than dimension	76	21	--	Fiji 19.
Sulfur:				
Elemental: Crude including native and byproduct	3,934	1,180	--	New Zealand 917; Indonesia 121.
Sulfuric acid	489	209	--	Papua New Guinea 71; Fiji 69; New Zealand 24.
Talc, steatite, soapstone, pyrophyllite	122,349	183,376	14,005	Japan 120,312; Republic of Korea 15,745; Netherlands 15,252.
Other:				
Crude	11,285	52,275	18,577	Japan 16,247; Netherlands 4,718; France 2,475.
Slag and dross, not metal-bearing	92	13,340	--	Singapore 8,204; Norway 5,000.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	25,148	27,766	--	Indonesia 12,999; New Zealand 5,712; Republic of Korea 1,734.
Coal:				
Anthracite and bituminous thousand tons	88,751	92,256	57	Japan 42,630; Republic of Korea 8,518; France 4,456.
Lignite including briquets do	26	53	--	Republic of Korea 39; Italy 4; Japan 4.
Coke and semicoke do	168	471	(6)	India 236; Republic of Korea 85; Romania 60.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude thousand 42-gallon barrels	41,390	24,019	16,983	Japan 3,128; Singapore 1,991.
Refinery products:				
Liquefied petroleum gas do	18,670	19,570	NA	NA.
Gasoline do	2,700	2,093	13	Fiji 619; New Zealand 485; Papua New Guinea 431.
Mineral jelly and wax do	14	18	--	New Zealand 11; Malaysia 3.
Kerosene and jet fuel do	5,643	6,093	7	Fiji 754; New Zealand 519; bunkers 4,063.
Distillate fuel oil do	4,895	4,697	42	Papua New Guinea 1,038; Fiji 844; New Zealand 626.
Lubricants do	1,472	1,238	95	New Zealand 237; Singapore 161; Hong Kong 145.
Residual fuel oil do	8,983	10,075	1,661	Singapore 2,058; Papua New Guinea 1,408; bunkers 4,437.
Bitumen and other residues do	--	1	--	Mainly to Tonga.
Bituminous mixtures do	5	3	--	New Zealand 1; Vanuatu 1.

rRevised. NA Not available.
[1]Table prepared by Audrey D. Wilkes. Import data for 1985 and 1986 were not available at the time of publication.
[2]Data from Australian Mineral Industry Annual Review Preliminary Summary 1987.
[3]May include platinum-group metals.
[4]Unreported quantity valued at $1,534,000.
[5]Unreported quantity valued at $24,000.
[6]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum, Alumina, and Bauxite.—The production of aluminum rose 14% over that of 1986, while alumina production increased 7% and bauxite production increased 5% during 1986. Production for all three established record highs. Aluminum production increased primarily because the five established smelters—Bell Bay in Tasmania; Boyne Island, Queensland; Kurri Kurri, New South Wales; Point Henry, Victoria; and Tomago, New South Wales—operated at nearly 100% of capacity. Production at the sixth smelter in Portland, Victoria, which went on-line in November 1986, was at about 70% of capacity. The increase in alumina was due mainly to increased production at the Gladstone refinery to meet higher world demand.

Exports of bauxite in 1987 decreased 10% to 4.5 million tons. Alumina and aluminum exports, however, increased 8% and 21%, respectively, attaining record highs of 8.3 million tons and 700,000 tons.

A proposal for a two-potline, 280,000-ton-per-year smelter with an associated power station was submitted to the Western Australian government by Western Australian Aluminium Smelter Consortium Ltd. near yearend. The proposal designated a site near Bunbury, south of Perth, for the smelter. The first potline would be commissioned in 1992 and the second in 1996.

BHP-Utah Minerals International Inc. announced in July its intention to sell its 20% share in the 1-million-ton-per-year alumina refinery and associated bauxite mine at Worsley, Western Australia. By yearend, it had conditionally agreed to the sale to Hydro Aluminium A/S of Norway. The conditions included approval by the Australian Government and agreement of the other joint-venture partners, Reynolds Australia Alumina Ltd., 40%, Shell Co. of Australia Ltd., 30%, and Kobe Alumina Associates, 10%.

Aluvic, a join venture in which the Victoria State government holds a 35% share, was looking into the possibility of constructing a $22.5 to $30 million aluminum casting plant at its Portland smelter.

Copper.—Mine production of copper continued to decline in 1987, decreasing 10%,

owing to decreased output at Australia's two largest copper mines, Mount Isa Mine, Queensland, and Mount Lyell Mine, Tasmania. Production decreased at the Woodlawn Mine, New South Wales, during the changeover from surface to underground mining. The small Warrego Mine, near Tennant Creek, Northern Territory, ceased copper production in February.

Construction progressed on schedule to meet the October 1, 1988, target date for the first copper metal pour at the on-site refinery at the huge Olympic Dam copper-gold-silver-uranium project at Roxby Downs Station, South Australia, owned by Roxby Mining Corp. Pty. Ltd., a subsidiary of Western Mining Corp. Holdings Ltd. (WMCH), 51%, and BP Australia Ltd., 49%. Scheduled production was to be 30,000 tons of cathode-grade copper bar per year produced from 1 million tons of copper-uranium ore. The refinery will use the Isa process technology developed by Copper Refineries Pty. Ltd., a wholly owned subsidiary of MIM Holdings Ltd.

A joint venture consisting of Cyprus Minerals Australia Co., 37.5%, Arimco NL, 37.5%, and Elders Resources Ltd., 25%, announced in midyear plans to develop the Starra copper-gold deposit and to commission a processing plant the first quarter of 1988. Mining was planned at a rate of 750,000 tons of ore per year to produce 10,000 tons of copper-in-concentrate. Starra is 150 kilometers southeast of Mount Isa.

Renison Goldfields Consolidated Ltd. announced that underground mining at its Mount Lyell Mine, Queenstown, Tasmania, will continue beyond the previously scheduled closure date of June 1989, following a pledge of financial assistance from the Tasmanian State government. The aid will enable the selective mining of 7.5 million tons of ore grading 1.95% copper from the deeper 50 and 60 series stopes. Mine closure is likely to be in 1994, following the completion of mining the 60 series stope.

Barrack Mines Ltd., the operator holding a 66% interest, announced the development of the polymetallic-mineralized deeper levels of the Horseshoe Lights gold mine, 135 kilometers north of Meekatharra, Western Australia. A plant was under construction for the production of 60,000 tons of copper concentrate beginning in the first quarter of 1988. Eastern Petroleum Australia Ltd., 28.5%, and Samantha Exploration NL, 5.5%, were the other partners in the mine.

Gold.—The production of gold in Australia, which increased for the seventh consecutive year, was 3.47 million troy ounces in 1987, an increase of 44% and the highest since 1906. Australia's peak gold production, 3.8 million ounces, was attained in 1903.

The Telfer Mine in Western Australia, owned and operated by Newmont Holdings Pty. Ltd., 70%, and BHP Gold Mines Ltd., 30%, replaced the Kidston Mine, Queensland, as Australia's preeminent gold producer. The Kidston Mine, owned by Canada's Placer Development Ltd., 70%, Australia's Elders IXL Ltd., 15%, and Australian public shares, 15%, remained Queensland's largest producer. The Granites Mine, owned by North Flinders Mines Ltd., displaced the Enterprise Mine, owned by Renison Goldfields, 60%, and Enterprise Gold Mines NL, 40%, as the Northern Territory's biggest producer. The Stawell Mine, a joint venture of WMCH, 75%, and Central Norseman Gold Corp., 25%, remained Victoria's major producer. Paragon Resources Ltd.'s Temora gold-silver mine, commissioned in May, became the largest gold mine in New South Wales, supplementing byproduct gold produced from base metal mining. Although commencement of production at the Olympic Dam deposit at Roxby Downs Station will considerably expand gold output, South Australia remained a small producer in 1987. Production of gold in Tasmania remained primarily a byproduct of base metal mining.

Exploration for gold accounted for more than 50% of the amount spent on exploration for nonfuel minerals in 1987, resulting in the discovery of numerous potential gold mines, primarily extensions of known ore trends. A few sites were virgin ore bodies. A partial list of gold mines and treatment plants commissioned during the year is as follows: Agricola, Queensland (Astrik Resources NL); Bardoc, Western Australia (Aberfoyle Exploration Pty. Ltd., 57%, and Hill Minerals NL, 43%); Bellevue, Western Australia (Queen Margaret Gold Mines NL, 50%, and Spargos Exploration NL, 50%); Boddington, Western Australia (Worsley Joint Venture Partners—Reynolds Australia, 40%, Shell Australia, 30%, BHP Gold, 20%, and Kobe Alumina Associates, 10%); Cosmo Howley, Northern Territory (Dominion Gold Mines NL, 50%, Regent Mining Ltd., 45%, and Southern Goldfields Ltd., 5%); Cracow, Queensland (Costain Securities (NSW) Pty. Ltd., 50%, Sedimentary Holdings Ltd., 37.5%, and Cracow Gold Ltd.,

12.5%); Croydon, Western Australia (Central Coast Exploration NL); Gabanintha, Western Australia (Dominion Gold, 50%, Southern Ventures NL, 25%, Black Swan Gold Mines NL, 25%); Gidgee, Western Australia (Montague Gold NL, 47%, Cyprus Minerals Australia, 26.5%, and Hudspeth & Co. Ltd., 26.5%); Gibralter, Western Australia (Pan Australian Mining Ltd.); Goongarrie, Western Australia (Julia Mines NL); Hellyer, Tasmania (Aberfoyle Ltd.); Kurara (Nord Resources (Pacific) Pty. Ltd.); Mertondale, Western Australia (Hunter Resources Ltd.); Mount Fisher, Western Australia (Sundowner Minerals NL); New Celebration, Western Australia (Newmont Holdings, 60%, Hampton Australia Ltd., 25%, Mount Martin Gold Mines NL, 15%); Pajingo, Queensland (Pajingo Gold Mines Pty. Ltd.); Premier, Western Australia (Kalgoorlie Resources NL); Sheahan-Grants, New South Wales (Climax Mining Ltd., 50%, Cyprus Minerals Australia, 25%, Arimco, 25%); Temora, New South Wales (Paragon Resources); White Devil, Northern Territory (Australian Development Ltd.); and Youanmi, Western Australia (Eastmet Ltd.).

An $11 million precious metals refinery, the first of its kind in Australia, was planned for Sydney, New South Wales, to produce gold and silver bullion from residues and scrap. It would be built by the joint-venture Pacific Precious Metals Ltd. The refinery was scheduled to be operational by December 1988. The joint venture comprised Tolltreck Systems Ltd., 40%; MIM Holdings, 30%; and Noranda Minerals Inc., 30%.

The Golconda Minerals NL and Minefields Exploration NL 50-50 joint venture announced plans to develop the old Mount Mulgine molybdenum-tungsten deposit, 85 kilometers northeast of Perenjori, Western Australia, into an open pit gold mine. Reserves at Mount Mulgine were 47.5 million tons of molybdenum-tungsten ore with significant gold values, up to 3.5 grams per ton, plus silver. Exploration and further delineation of reserves was scheduled through June 1990.

At yearend, Western Australia was planning to establish an international gold bank, to be owned by the State and headquartered in Perth. The Gold Banking Corp. would issue notes backed by gold bullion or by Australian Nuggets, Australia's legal tender, 99.99%-gold coins. This would make Australia the only country in the world to issue gold-backed notes. The Gold Bank would also operate the Perth Mint and gold refinery and assume the crushing, milling, and gold recovery operations previously done by the Western Australian State Batteries.

Peko-Wallsend Ltd. announced plans at yearend to build a carbon-in-pulp gold recovery plant to treat the accumulated tailings at the Warrego Mine. The tailings reserve was 4.5 million tons grading 1.03 grams of gold per ton. More than 90,000 ounces of gold will be reclaimed.

Croesus Mining NL and Indian Ocean Resources Ltd. entered into a joint-venture agreement to treat 2 million tons of tailings at Lakewood Trailings near Kalgoorlie in Western Australia. About 30,000 ounces of gold were expected to be recovered.

Plans for the Starra copper-gold deposit, described in the "Copper" section, were to produce 500,000 tons of ore per year from four separate open pits and an additional 250,000 tons per year from underground, extracting a total of 100,000 ounces of gold.

The Broken Hill Pty. Co. Ltd. (BHP) transferred into a separate gold company, BHP Gold Ltd., all of its gold interests, excluding its stake in the Ok Tedi Mine in Papua New Guinea and those interests held by its Utah International Div. BHP retained a 55% holding in the new company and continued to manage the properties and market the gold. The remaining shares were offered to BHP shareholders. Among the new company's interests were Boddington, Western Australia, 20%; Browns Creek, New South Wales, 100%; Coronation Hill, Northern Territory, 45%; Gympie, Queensland, 55%; Ora Banda, Western Australia, 100%; and Telfer, Western Australia, 30%.

Iron and Steel.—Production of iron ore in 1987 increased 6%, breaking the previous record high set in 1975. The increase reflected the effectiveness of programs to expand production at some mines, the policy of building stocks at port facilities by the major producers, and a strengthening in export demand, especially during the second half of the year, following a higher level of steel production in Japan and Western Europe. However, iron exports decreased 3%. A surge in iron ore exports during the last half of the year did not offset the reduced level of shipments earlier in the year. Iron ore contract prices negotiated early in the year were down another 4% to 9% from the previous year, due to an

excess of supplies in the world market.

Production of pig iron and steel were adversely affected by industrial disputes and decreased 5% and 10%, respectively, from that of 1986. Output of steel produced by BHP's steel division decreased 10% at the Newcastle Steelworks, New South Wales; 12% at the Port Kembla Steelworks, Wollongong, New South Wales; and 1% at the Whyalla Steelworks, South Australia, all relative to the previous year.

Australian iron ore production remained heavily concentrated in the Pilbara District of Western Australia, which accounted for more than 95% of production. Hamersley Iron Pty. Ltd., the major Pilbara producer and wholly owned by CRA Ltd., reached agreement with the China Metallurgical Import and Export Corp. (CMIEC) in June to jointly develop the 200-million-ton Channar iron ore deposit, 20 kilometers east of Hamersley Iron's Paraburdoo Mine. Construction was to begin in early 1988. Production was to begin in 1990 at the rate of 3 million tons per year, progressively increasing to 10 million tons per year. The open cut would use Hamersley Iron's existing plant, rail, and port. Channar production was to be blended with output from Hamersley Iron's other mines. The Channar project would be the first overseas mining project in which China held a direct equity interest. It also would be the first new development in the Pilbara since 1973. It was to be operated as a joint venture by Hamersley Iron and CMIEC, with Channar Mining Pty. Ltd. holding 60% and CMIEC Channar, 40%.

Robe River Iron Associates purchased BHP's 50% interest in the Robe River project's railway and Cape Lambert port facilities, as well as BHP's remaining Deepdale pisolitic limonite iron ore resources in February. These ore bodies, estimated to exceed 2 billion tons, were adjacent to Robe River's Pannawonica (East Deepdale) Mine.

An agreement was reached in May between Mount Newman Mining Co. Pty. Ltd. and Hancock Mining Ltd. providing for the limited mining of Hancock Mining's McCameys Monster iron ore mine, 35 kilometers southeast of Mount Newman, by Mount Newman Mining at the rate of 750,000 tons per year. Mount Newman Mining was to service the iron ore contracts, which Hancock Mining had negotiated with the Romanian Government, with ore from the Mount Newman Mine beginning in 1988 while McCameys Monster was being developed.

In May, BHP commissioned its $35 million, 130,000-ton-per-year-capacity steel minimill at Acacia Ridge in the Brisbane area. The steel rolling mill will produce merchant and reinforcing bar products and specialized rods using semifinished billets supplied by BHP's plant at Newcastle. The mill will be operated by BHP Queensland Steel Ltd. BHP announced it would build a small steel mill at Rooty Hill, Sydney, with a capacity to produce 250,000 tons of merchant bar products per year from steel scrap. The mill was tentatively scheduled to come on-stream in 1989.

The installation of a continuous bloom caster and reheat furnace was completed at BHP's Newcastle Steelworks in April.

Mount Newman Mining announced that it would expand production capacity at its Orebody 29 Mine, 2 kilometers south of Mount Newman Mining's operation at the huge Mount Whaleback Mine. The upgrade, from 2 million to 5 million tons per year, would cost $32 million. The work will include a new ore-handling plant, additional mining equipment, new train-loading facilities for the ore, a new conveyor, modifications of the Nelson Point facilities at Port Hedland, Western Australia, and some additional infrastructure at Mount Newman.

At its Laverton, Victoria, minimill, Humes Smorgon Steel Pty. Ltd. will increase billet and merchant-bar production capacity from 200,000 tons per year to 308,000 tons per year. Other planned improvements include new melting facilities, a rod mill, and new scrap-handling equipment.

Commonwealth Steel Co. Ltd. commissioned a new 50-ton-capacity electric arc and ladle furnace at its Waratah, New South Wales, works early in the year, increasing production capacity for special alloy steels from 108,000 tons per year to 130,000 tons per year.

Lead and Zinc.— In 1987, mine production of lead and zinc increased 6% and 11%, respectively, owing primarily to the return to production without work stoppages at the mines at Broken Hill, New South Wales, and the startup of production at Aberfoyle's Hellyer copper-lead-silver-zinc mine in Tasmania. Australia remained the world's leading producer of mined lead and third leading producer of mined zinc, after Canada and the U.S.S.R. Lead production increased slightly at the Woodcutters Mine, owned by Nicron Resources Ltd., 77%, Lachlan Re-

sources NL, 12.5%, and Petrocarb Exploration NL, 10.5%, in the Northern Territory; decreased slightly at Cobar Mines Pty. Ltd.'s Cobar Mine and Denehurst Ltd.'s Woodlawn Mine, both in New South Wales; and remained about the same as that of 1986 at MIM Holdings' Mount Isa Mine, and North Broken Hill Ltd.'s mines at Rosebery, Tasmania, and Elura, New South Wales. Mined zinc production increased at the Cobar Mine; decreased at the Mount Isa, Woodcutters, and Woodlawn Mines; and remained about the same as that of the previous year at the Elura and Rosebery Mines.

Lead bullion production increased 5% primarily because of the increased production of mined lead at Mount Isa. Lead bullion was produced at the on-site smelter at Mount Isa and at the Cockle Creek smelter, New South Wales, owned by the Sulphide Corp. Pty. Ltd., a wholly owned subsidiary of CRA. Production of primary refined lead increased at Broken Hill Associated Smelters Pty. Ltd.'s (BHAS) Port Pirie refinery. The refinery, Australia's sole producer, had experienced shortages of lead concentrate feedstock in 1986 because of work stoppages at the Broken Hill mines between May 26 and July 22. Estimated production of refined lead from secondary sources increased 5%.

Primary refined zinc production was slightly higher in 1987. It increased at Electrolytic Zinc Co. of Australasia Ltd.'s Risdon, Tasmania, refinery and at the Port Pirie refinery, but decreased slightly at the Cockle Creek refinery.

Underground development, trial mining, and metallurgical testing continued at MIM Holdings' Hilton lead-silver-zinc mine, 20 kilometers north of Mount Isa. High-grade ore was extracted at a rate of 2,000 tons per week and trucked to Mount Isa for processing in the lead-zinc concentrator. It was being planned that a commercial mine would begin operating in the late 1980's at Hilton, integrating its ore with that of Mount Isa. Production would be increased to about 2.5 million tons per year by the mid-1990's to offset declining production at Mount Isa. Reported primary reserves at the end of June were 11 million tons of proven ore grading 6.7% lead, 9.1% zinc, and 154 grams of silver per ton and 38 million tons of probable ore grading 6.4% lead, 9.3% zinc, and 150 grams of silver per ton.

Mining operations began at the Cadjebut lead-zinc deposit in the Kimberley District of northwestern Western Australia in June. The mine is a joint venture between BHP, 58%, and Billiton Australia Ltd., 42%. The high-grade ore was stockpiled on-site until the concentrator came on-stream in the first quarter of 1988. The mine was expected to produce 320,000 tons of ore per year, producing concentrates of 80,000 tons grading 55% zinc and 17,000 tons grading 75% lead annually. All concentrate was to be shipped to Southeast Asia, Europe, and other parts of Australia from the Western Australia port of Wyndham. Operations at Cadjebut marked the first base metal mining by BHP since it ceased operations at its namesake, the Broken Hill Mines in New South Wales in 1939.

A fire in a sinter plant control room at yearend caused a 6-week closure of the Port Pirie refinery, resulting in the loss of 20,000 tons of refined lead. Contractual commitments were maintained, however, from inventory stockpiled for use during the scheduled shutdown for maintenance in January 1988. Production of refined zinc continued, although at about 70% to 75% of nominal capacity.

BHAS will upgrade its facilities at Port Pirie over a 4-year period beginning in 1988 to comply with environmental regulations, to increase operating flexibility, and to maintain production.

Aberfoyle announced at yearend an $84 million program to quadruple mining operations and construct a new 1-million-ton-per-year ore treatment plant at its Hellyer underground mine, Tasmania, which came on-stream earlier in the year. The mine had been using the old Cleveland tin milling facility, which had been converted to process 250,000 tons of copper-lead-silver-zinc ore. Average production at a 1-million-ton-per-year throughput, will be 45,000 tons of lead concentrate, 170,000 tons of zinc concentrate, 100,000 tons of bulk lead-zinc concentrate, and 10,000 tons of copper-silver concentrate. Gold is also present in the ore, but recovery is likely to be minimal because of the ore's refractory nature. The project was scheduled to be completed in early 1989 and was to gradually replace output from Aberfoyle's Que River Mine, scheduled for closure in 1991.

Electrolytic Zinc commissioned a feasibility study early in the year on expanding the Risdon, Tasmania, zinc smelter-refinery by up to 45% to 320,000 tons per year. This would be in addition to the 4-year moderni-

zation program begun at the start of the year to replace the leaching and purification plant.

The major mines at Broken Hill began operating under revised conditions in February after the miners voted to accept the recommendations of the New South Wales Industrial Commission that the number of weekly shifts be increased to 21 from 19 and that some safety practices be changed. The dispute over the proposed changes and the unions' refusal to accept them led to a 2-month shutdown beginning in May 1986. The miners returned to work in July 1986, under an interim agreement that increased the number of shifts from 15 to 19.

Manganese.—Production of manganese ore in Australia, all on Groote Eylandt in the Gulf of Carpentaria, Northern Territory, by Groote Eylandt Mining Co. Pty. Ltd., a wholly owned subsidiary of BHP, increased 12% owing to the completion of a modernization program that raised the ore treatment capacity from 750 to 1,000 tons per hour and concentrate production capacity from 2.3 to 2.4 million tons per year.

Manganese alloy (ferromanganese and silicomanganese) production at the Bell Bay plant by Tasmanian Electro Metallurgical Co. Pty. Ltd., also wholly owned by BHP, increased by more than 40% following the completion in midyear of a 3-year expansion program that raised production capacity from 135,000 to 190,000 tons per year.

Late in the year, BHP announced through its wholly owned subsidiary BHP-Utah Minerals International that it planned to build a plant at Newcastle, New South Wales, to produce electrolytic manganese dioxide used in the manufacture of dry cell batteries. Beginning in late 1989, the plant, to be fed with ore from the Groote Eylandt Mine, was to have the capacity to produce 15,000 tons of manganese dioxide per year, about 10% of the combined capacity of market economy countries. About 90% of production was to be exported.

BHP announced an agreement with CMIEC for a feasibility study on establishing in China a 60,000-ton-per-year manganese ferroalloy plant that would be fed by ore from the Groote Eylandt Mine. A decision to proceed would increase the average 170,000-ton-per-year shipments of manganese ore to China and probably establish a 50-50 joint venture.

Mineral Sands.—Australian producers of mineral sands, which are high concentrations of the heavy-minerals rutile, ilmenite (including leucoxene), zircon, and monazite, operated at full mining capacity throughout the year, with estimated production of concentrates increasing by 7%. Australia retained its ranking as the world's leading producer and exporter of mineral sands, producing an estimated 40% to 60% of world production. Ilmenite production increased 11%, monazite output decreased 14%, rutile production increased 19%, and zircon production decreased 3%. Leucoxene production decreased 14%.

The TiO_2 Corp. NL, 50%, and Kerr McGee Chemical Corp., 50%, announced plans to develop a mineral sands mine and concentrator at Cooljarloo, 170 kilometers north of Perth, as well as separate synthetic rutile (SR) and titanium dioxide (TiO_2) pigment plants. Annual production was expected to be 300,000 tons of ilmenite, 40,000 to 60,000 tons of zircon, 20,000 to 40,000 tons of rutile, and 2,500 tons of monazite. Production from the mineral sands plant was scheduled to start by mid-1989, the SR plant in January 1990, and the TiO_2 plant in mid-1990.

CRA reportedly discovered one of the world's largest deposits of heavy-mineral sands in the Horsham region of western Victoria. The deposit was described as having 1 billion tons of proven ore in the primary exploration area containing more than 3% heavy minerals and a larger resource of 4.9 billion tons averaging more than 2% heavy minerals. Estimated reserves in the primary exploration area were 12.5 million tons of ilmenite, 5.1 million tons of zircon, 4.6 million tons of leucoxene, 3.4 million tons of rutile and anatase, 580,000 tons of monazite, and 170,000 tons of xenotime.

Consolidated Rutile Ltd. commissioned its 175,000-ton-per-year low-chromium ilmenite upgrading plant at Meeandah, Queensland, in March. Consolidated Rutile was planning to increase the plant's capacity to 250,000 tons per year in mid-1988.

Westralian Sands Ltd. commissioned its 110,000-ton-per-year SR plant at North Capel, Western Australia, in February.

Associated Minerals Consolidated Ltd., the world's largest producer of mineral sands and a wholly owned subsidiary of Renison Goldfields, opened its third, and Australia's fourth, SR plant at Narngulu, near Geraldton, Western Australia, in

April. The plant will process ilmenite from the company's mines at Eneabba and at full capacity will produce 112,000 tons of SR per year.

Mineral Deposits Ltd., a wholly owned subsidiary of BHP, commissioned its new mining operation at Viney Creek, north of Newcastle, New South Wales, in midyear. The mineral sands concentrates were processed through the company's adjacent Hawks Nest plant.

Nickel.—Mine production increased at WMCH's mines at Mount Windarra and in the Kambalda-St. Ives areas of the Kalgoorlie District, both in Western Australia, as well as at Queensland Nickel Pty. Ltd.'s Greenvale Mine in Queensland. Nevertheless, Australia's nickel production decreased by 3% owing to the suspension of mining at two large mines in Western Australia—the Agnew Mine, owned by BP Australia, 60%, and MIM Holdings, 40%, in August 1986 and the Nepean Mine, owned by Metals Exploration Ltd., in May 1987. The Agnew Mine remained on care and maintenance, to be reopened when market conditions permit and the Nepean Mine was exhausted.

Nickel content of nickel matte produced at WMCH's Kalgoorlie nickel smelter decreased 2% from that produced in 1986, largely owing to the loss of available concentrate feed from the Agnew Mine. The decline was partially offset by increased production from the Kambalda Field and Mount Windarra. The nickel content of nickel oxide sinter produced at Queensland Nickel's Yabulu, Queensland, refinery near Townsville remained at about the same level as that of the previous year. Refined nickel from WMCH's Kwinana, Western Australia, nickel refinery increased 14%. Queensland Nickel was exploring the possibility of importing nickel ore from New Caledonia and/or Indonesia for treatment at the Yabulu plant. Yabulu was being fed with ore from the nearby Greenvale Mine, but its reserves will be exhausted by about 1991, and Queensland Nickel was looking into other source material to save the facility from closure. Yabulu employed about 700 people.

In November, Australia gave notice of its intention to become a foundation member of the new International Nickel Study Group, a producer-consumer forum designed to encourage information sharing about world nickel trade. The Study Group was to become effective when 15 countries, accounting for more than 50% of world nickel trade accept the terms of membership.

Tin.—Australian production of tin-in-concentrates decreased 12%. The Tolltreck Metal Products Ltd. tin smelter at Alexandria in Sydney, and Greenbushes Ltd.'s tin smelter at its tin-tantalum mine south of Perth, reduced smelting operations to part-time owing to the shortage of suitable concentrates. As a result, production of primary refined tin decreased by 57%.

Renison Goldfields' large, hard-rock, underground Renison Bell Mine in Tasmania produced at its 850,000-ton-per-year capacity throughout the year after returning to a 24-hour, 7-day-per-week schedule in April 1986. Renison continued to toll smelt its tin concentrates in Malaysia and to develop its own markets for the metal, which it began doing soon after the collapse of the International Tin Council in October 1985.

Kokan Mining Co. Ltd., a subsidiary of Nippon Kokan K.K. of Japan, and Greenbushes were planning to jointly mine tin and tantalum ore in the Pilbara District beginning in the spring of 1988. The tin and tantalum deposits, located about 200 kilometers south of Port Hedland, were first discovered by Greenbushes in the late 1970's. Kokan Mining established a subsidiary, Western Australia Rare Metals Co., to conduct further tests and feasibility studies between mid-1986 and mid-1987 with financial backing from the Metal Mining Agency of Japan. The production of tin and tantalum reportedly will be shared equally by Kokan Mining and Greenbushes.

Tungsten.—Australia remained one of the market economy countries' leading tungsten producers, despite the fall of 1987 production to about 32% of the peak reached in 1980, as a result of continued low prices and weak demand. Production of tungsten in concentrates decreased 28%. About 65% of output came from Peko-Wallsend's subsidiary, King Island Scheelite Pty. Ltd., which was producing from its Dolphin Mine on King Island, Tasmania. The remainder was produced by Tasmania Mines NL from its Kara Mine in northern Tasmania.

King Island Scheelite continued to operate at 50% of rated capacity at its Dolphin Mine. The company's Bold Head Mine on King Island remained on care-and-maintenance status. Production from the Kara Mine was reduced because of metallurgical problems at the mill and a reduction from three shifts to one shift per day.

Australia's second largest capacity tungsten mine, Mount Carbine near Cairns, Queensland, of Queensland Wolfram Pty. Ltd., owned by Poseidon Ltd., 66.6%, and R. B. Mining Pty. Ltd., 33.3%, remained on care and maintenance.

Virtually all production was exported, mainly to the Federal Republic of Germany, the United States, and the U.S.S.R. The only Australian consumer of domestic supplies was Seco-Titan Pty. Ltd., which used minor amounts for the production of ammonium paratungstate and tungsten carbides.

INDUSTRIAL MINERALS

Diamond.—Argyle Diamond Mines Pty. Ltd., a joint venture of CRA (56.8%), Ashton Mining Ltd. (38.2%), and the Western Australian government-owned West Australian Diamond Trust (5%), remained the world's leading diamond producer, producing more natural diamond by itself than that produced by any country in the world. Argyle produced more than De Beers Consolidated Mines Ltd.'s 16 wholly and partially owned diamond operations in Botswana, Namibia, and the Republic of South Africa. Argyle accounted for 36% of the world's diamond output in 1987 from its AK-1 kimberlite (lamproite) pipe mine in the Kimberley District. Diamonds from the AK-1 pipe consisted of 6% gem, 39% near gem, and 55% industrial grades, the lowest proportion of gem-quality diamond compared with that from any leading producer country in the world. As a result, although Argyle increased the world's supply of newly mined diamonds by 49%, the value of the world's diamond supply only increased 7%.

Argyle Diamond Sales Ltd. (ADS), jointly owned by Ashton and CRA, continued to market 95% of the joint venture's production. Except for a small quantity of high-quality diamonds retained for cutting and polishing in Western Australia, all of the gem production and 75% of the near-gem and industrial-grade rough diamond was marketed to De Beers' Central Selling Organization, which controlled 80% of the world's supply and marketing of diamonds, in London, England. The balance of near-gem and industrial-grade diamonds was sold by ADS to the international market through its Antwerp, Belgium, office. ADS marketed its gem diamonds through selected jewelers, and the West Australian Diamond Trust marketed its 5% share of production separately.

In August, the Bow River Joint Venture, consisting of Freeport-McMoRan Australia Ltd., 80%, and Gem Exploration and Minerals Ltd., 20%, began constructing a plant 20 kilometers east of the Argyle Diamond Mines' leases for the treatment of diamondiferous alluvium from the Limestone Creek and Bow River area. The plant was expected to become operational in early 1988, processing 4,000 tons of alluvial gravel per day. Diamond production was expected to be 600,000 carats per year, consisting of 18% to 25% gem quality, 65% to 72% near gem, and 8% to 10% industrial-grade diamond.

Freeport-McMoRan, 50%, and Triad Minerals NL, 50%, completed a stream sediment sampling program toward yearend, from which many diamond indicator minerals were recovered, at their Mount Elizabeth diamond project in the east Kimberley District. Mapping has identified two kimberlite-lamproite pipes over the 400-square-kilometer area.

Gem Stones.—Apart from diamond, gem stone mining in Australia consisted principally of opal and sapphire. Small quantities of other gem stones, such as amethyst, chrysoprase, emerald, garnet, nephrite jade, rhodonite, topaz, and zircon, were also produced.

Australia retained its longstanding stature as the world's leading producer of natural sapphire. Australia provided 70% to 80% of the uncut sapphire imported by Thailand, the recognized world leader in the processing and marketing of sapphire in 1987. Sapphire was mined in the Anakie District of central Queensland and in the New England (Inverell-Glen Innes) District of New South Wales.

From 80% to 90% of the world's natural opal was produced in Australia in 1987. Most of Australia's opal was mined from three fields in South Australia: Andamooka, Coober Pedy, and Mintabie, the largest producer. A smaller amount of opal was also produced in central-northern New South Wales at Lightning Ridge, which was also the world's only source of black opal. A newly discovered field about 20 kilometers from Lightning Ridge, the Sheepyard Field, was showing promise for vastly increased production of opal in the future. A small quantity of opal, mostly the boulder opal variety but including other types, was produced in central Queensland where it occurs in a broad zone between Opalton in the north and Yowah in the south, near the

border with New South Wales.

Because most of the sales transactions were conducted privately between miner and buyer, reliable production and trade statistics for opal and sapphire were not available.

MINERAL FUELS

Coal.—For the fifth successive year, production, consumption, and exports of black coal attained record-high levels despite the continuance of massive world oversupply and depressed international prices. The coal industry was Australia's biggest foreign-exchange earner, accounting for more than one-third of export revenues from the minerals sector and 15% of the country's export earnings. It was also the country's largest employer. Raw coal production in Queensland, Australia's largest producing State for the third consecutive year, increased 2% to 85 million tons. New South Wales produced 83.7 million tons for a 4% increase. These two states accounted for more than 96% of the coal production and virtually all of the country's coal exports.

Domestic coal consumption increased 3% to an estimated 44.8 million tons. Approximately 90% of the domestic coal consumption was by the electricity and iron and steel industries, primarily using steaming and coking coals, respectively.

Coal exports again recorded record-high tonnages, increasing 10%. Queensland's coal exports increased 16% accounting for 58% and 59.2 million tons of the total, and exports from New South Wales increased 7%, to 42.8 million tons.

The Commonwealth Scientific and Industrial Research Organization patented a process for making coal that is nearly free of mineral impurities and that can be used as a substitute for heavy fuel oil.

Petroleum and Natural Gas.—Despite its relative self-sufficiency in oil and gas production, which meets 80% to 85% of domestic needs, Australia remained a minor producer in terms of world standards. Unless significant new oilfields are discovered, Australian production can be expected to decline significantly by 1990. Output of crude oil and condensate increased 7% to 200 million barrels, although still below 1985's record-high production level. Production of liquefied petroleum gas declined 1%. Natural gas production increased 2% to 530 billion cubic feet, establishing a new record.

More than 90% of the crude oil continued to come from the Gippsland Shelf fields in the Bass Strait between Victoria and Tasmania. The majority of the remaining production was from the Barrow Island Field off Western Australia and from the Cooper and Eromanga Basins in South Australia and Queensland.

The number of exploration wells drilled onshore, 211, was substantially higher than that of 1986. However, the number of exploration wells drilled offshore, 15, was only one-half the number drilled in 1986. The total number of wells drilled, 282, increased by 60% compared with that of 1986. The number of development wells drilled, 56, increased by 51% although offshore development drilling remained at about the same level as in 1986. Seismic activity included 41,097 line kilometers being shot, of which 24,889 kilometers were offshore.

Uranium.—Production of uranium oxide (U_3O_8) in Australia decreased 9% owing to decreased production at both the Ranger Mine, owned by Energy Resources of Australia Ltd. (ERA), and the stockpiled ore at the Nabarlek operation, owned by Queensland Mines Ltd. (QML). ERA produced 3,103 tons of U_3O_8, a decrease of 11% from that of 1986, and QML produced 1,354 tons of U_3O_8, a 3% decrease. Uranium was Australia's second most valuable energy export.

Although Australia produced 11% of the market economy countries' uranium output in 1987 and was the fourth largest producer behind Canada, the United States, and the Republic of South Africa, the industry was of comparatively little importance to the nation's economy. All uranium was produced for export because Australia had no nuclear powerplants. However, the Government operated a small reactor at Lucas Heights, near Sydney, for research and the production of isotopes and radiopharmaceuticals for medical use.

Underground development of the mine and erection of a metallurgical plant and a flash smelting furnace at the Olympic Dam project at Roxby Downs Station progressed throughout the year. The service decline, the main access to the underground workings, was completed in June. The production of uranium would begin by the target date of October 1, 1988, at the rate of 2,000 tons per year, and this would more than offset the rapidly depleting stocks at the Nabarlek Mine, expected to be exhausted by July 1988. Production was to increase to 3,000 tons per year within 4 years after startup. The mine's owners reported that, as of yearend, they had long-term agree-

ments for the sale of uranium to the Swedish State Power Board, the Central Electricity Generating Board of the United Kingdom, and the Korea Electric Power Corp. The agreements were said to cover 31% of planned production.

CRA Exploration Pty. Ltd. reported that evaluation drilling at the Kintyre prospect, located just inside the northern boundary of the Rudall River National Park in Western Australia, had identified 15,000 tons of probable reserves of U_3O_8 and an additional 17,000 tons of possible U_3O_8 reserves. CRA Exploration was planning to explore the deposit further during 1988.

The Queensland Department of Mines approved the surrender of the mining leases held by Mary Kathleen Uranium Ltd. (MKU) in May and assumed the responsibility for environmental monitoring of the mining site near Mount Isa in June. MKU, owner of one of Australia's initial and most successful uranium mining operations, ceased mining in 1981 when economic reserves were depleted. It has since been concerned with site restoration and cleanup in accordance with environmental regulations and filling outstanding uranium contracts with Europe from stockpiled material. The final contract delivery was made in January 1985.

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[1]Physical scientist, Division of International Minerals.

[2]Converted from Australian dollars (A$) to U.S. dollars at the rate of A$1.00=US$0.687 in 1985, and A$1.00=US$0.75 in 1987.

The Mineral Industry of Austria

By Harold R. Newman[1]

The mining and mineral processing industries of Austria continued to contribute a moderate share to the gross domestic product (GDP). Mining operations by state-owned companies represented a major proportion of production, although contributions from private mining companies were significant. The Austrian Government had recognized the problems inherent with a nationalized industry and embarked on a policy of fiscal austerity, regulatory reform and economic restructuring. State industries, which soaked up the major proportion of Government subsidies and audit guarantees, were made more efficient and competitive. Under a typical restructuring, the Government retained a 51% stake in a state-run company while the remaining 49% was to be sold to the public in stages.

Real growth in the GDP slowed to 1% in 1987, as modest increases in domestic consumption offset declines in exports. The economic policy was expected to put Austria back on a growth path and headed toward a freer, more entrepreneurial economy. The problems of the state-owned sector masked the fact that most Austrian industry was healthy and in private ownership. Although no private Austrian firms were large by international standards, several were leaders in certain niches, such as specialized metallurgy and railroad track-laying machinery.

PRODUCTION

Industrial production, excluding energy, declined 2%. This was due mainly to falling exports and poor sales by state-owned steel firms. Restructuring efforts were underway in the steel industry with extensive layoffs initiated. Mining and metals production declined slightly except for aluminum, antimony, and lead. Production of industrial mineral commodities remained more or less steady. The output of the mining industry decreased overall by almost 5%, and the value of mineral products decreased by more than 14%. The worldwide economic problems with which the mining industry had to contend was well known. The Austrian mining and minerals sector was increasing its chance for survival by undertaking measures such as reorganization, minimizing administration, renewal of process technologies, modernization, and automation including computized controls. There were 86 active mines in Austria, 55 of them underground, 20 on the surface, and 11 with both underground and surface sections.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
METALS					
Aluminum metal:					
Primary	94,200	95,833	94,106	92,453	93,414
Secondary	56,785	56,579	58,592	56,354	62,731
Total	150,985	152,412	152,698	148,807	156,145
Antimony, mine output, Sb content of concentrate	659	523	477	514	450
Cadmium metal	46	49	52	52	26
Copper:					
Smelter, secondary	30,000	r24,600	25,900	25,500	e26,000
Refined:					
Primary	8,769	9,592	8,207	7,067	3,855
Secondary	33,131	34,293	34,966	32,579	32,924
Total	41,900	43,885	43,173	39,646	36,779
Germanium, Ge content of concentrate kilograms	6,000	4,800	5,500	6,300	e6,700
Iron and steel:					
Iron ore and concentrate:					
Gross weight thousand tons	3,540	3,600	3,270	3,120	3,050
Fe content do	1,107	1,138	1,019	976	953
Metal:					
Pig iron do	3,320	3,745	3,704	3,349	3,451
Ferroalloys, electric-furnace do	14	13	12	r e12	12
Steel, crude do	4,411	4,870	4,660	4,292	4,301
Semimanufactures do	3,555	3,842	3,760	3,462	3,432
Lead:					
Mine output, Pb content of concentrate	4,290	4,151	7,500	5,865	6,552
Metal:					
Smelter:					
Primary	4,210	1,707	1,930	e1,500	e2,600
Secondary	12,860	16,476	15,601	e15,000	e16,500
Total	17,070	18,183	17,531	e16,500	e19,100
Refined:					
Primary	12,000	10,000	10,000	r e6,000	e5,000
Secondary	11,500	16,200	15,500	r e19,000	e15,000
Total	23,500	26,200	25,500	r e25,000	e20,000
Manganese, Mn content of domestic iron ore	65,284	67,101	60,074	58,945	57,486
Tungsten, mine output, W content of concentrate	1,408	1,632	1,481	1,387	1,250
Zinc:					
Mine output, Zn content of concentrate	19,432	20,879	21,704	16,290	15,735
Metal refined	23,000	24,000	25,000	24,000	24,300
INDUSTRIAL MINERALS					
Cement, hydraulic thousand tons	4,907	4,899	4,560	4,569	4,522
Clays:					
Illite	381,598	285,553	212,678	268,451	275,921
Kaolin:					
Crude	402,511	455,695	500,844	444,852	444,927
Marketable	83,558	99,541	100,151	46,291	188,533
Other	32,946	18,058	49,161	33,037	12,961
Feldspar, crude	1,063	2,554	13,570	2,850	4,692
Graphite, crude	40,418	43,789	30,764	36,167	39,391
Gypsum and anhydrite, crude	750,921	740,117	693,993	701,749	664,452
Lime thousand tons	1,140	1,262	1,301	1,275	1,387
Magnesite:					
Crude do	1,006	1,183	1,255	1,084	947
Sintered or dead-burned do	320	377	389	315	345
Caustic calcined do	89	93	75	73	58
Nitrogen: N content of ammonia[e] do	2495	500	500	450	450
Pigments, mineral: Micaceous iron oxide	11,734	e11,500	11,583	11,730	10,807
Pumice (trass)	2,458	9,666	6,981	5,808	6,922
Salt:					
Rock thousand tons	1	1	1	2	1
In brine:					
Evaporated do	359	419	438	486	484
Other do	141	239	230	250	250
Total do	501	659	669	738	735

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
INDUSTRIAL MINERALS —Continued					
Sand and gravel:					
Quartz sand thousand tons	816	782	735	798	684
Other do	15,318	15,387	14,593	8,861	9,322
Total do	16,134	16,169	15,328	9,659	10,006
Sodium compounds, n.e.s.:[e]					
Carbonate, synthetic do	170	150	150	150	150
Sulfate, synthetic do	55	50	50	55	55
Stone:[3]					
Dolomite do	938	981	1,291	1,308	[e]1,400
Quartz and quartzite do	171	223	176	196	196
Other including limestone and marble do	11,977	11,903	11,667	9,250	9,540
Total do	13,086	13,107	13,134	10,754	11,136
Sulfur:					
Byproduct:					
Of metallurgy	9,429	10,113	11,204	10,986	10,448
Of petroleum and natural gas	32,000	28,342	24,250	29,348	30,946
From gypsum and anhydrite	26,122	26,449	26,547	23,837	13,091
Total	67,551	64,904	62,001	64,171	54,485
Talc and soapstone	122,128	134,011	131,454	133,319	129,959
MINERAL FUELS AND RELATED MATERIALS					
Coal, brown and lignite thousand tons	3,041	2,901	3,081	2,969	2,786
Coke do	1,725	1,854	1,751	1,744	1,727
Gas, natural:					
Gross million cubic feet	42,850	44,931	41,102	39,269	41,223
Marketed do	34,205	37,084	34,325	32,537	34,330
Oil shale	1,060	970	620	[4]	38
Petroleum:					
Crude thousand 42-gallon barrels	8,847	8,404	7,999	7,783	7,410
Refinery products:					
Gasoline do	16,407	17,499	18,184	[e]18,100	19,773
Kerosene and jet fuel do	1,079	1,461	1,452	1,381	1,517
Distillate fuel oil do	15,267	15,538	16,482	18,582	23,209
Residual fuel oil do	11,646	13,064	16,040	13,530	[e]12,000
Lubricants do	603	557	604	1,591	[e]1,200
Liquefied petroleum gas do	4,966	5,509	5,479	5,145	[e]5,100
Bitumen do	1,218	1,658	1,363	1,427	1,382
Unspecified do	676	235	182	220	225
Refinery fuel and losses do	3,064	3,090	3,292	3,502	2,759
Total do	54,926	58,611	63,078	63,478	65,965

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through Aug. 1988.
[2]Reported figure.
[3]Excluding stone used by the cement and iron and steel industries.
[4]Revised to zero.

TRADE

About 40% of Austrian goods and services was exported. Merchandise exports declined for the second year in a row; increased sales to Western Europe could not fully compensate for decreases in all other markets. Austria was not part of the European Economic Community (EEC), but two-thirds of its exports went to EEC members. The Austrian Government's concern was that the unification of the EEC market, scheduled for 1992, might cause EEC members to trade more among themselves and less with nonmembers, leaving Austria a no-man's land between the trading groups of Western and Eastern Europe. Austria sought closer integration with the EEC by aligning standards and regulations to EEC requirements and negotiating continued access to the EEC market. Because of Austria's heavy dependence on foreign trade, its Government generally supported efforts to create a freer and fairer global trading system.

Table 2.—Austria: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	(2)	626	--	Italy 572; Hungary 54.
Metal including alloys:				
Scrap	33,248	NA		
Unwrought	31,072	31,317	--	West Germany 12,612; Italy 6,215; France 5,892.
Semimanufactures	98,145	102,564	1,366	West Germany 37,692; Switzerland 8,058; Italy 7,605.
Copper:				
Matte and speiss including cement copper	24	2	--	All to West Germany.
Sulfate	123	NA		
Metal including alloys:				
Scrap	19,525	NA		
Unwrought	26,758	24,327	--	Italy 14,431; West Germany 6,851; Switzerland 1,880.
Semimanufactures	16,483	18,869	190	West Germany 8,639; Italy 3,036; France 2,299.
Gold: Metal including alloys, unwrought and partly wrought, troy ounces	16,397	NA		
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	50	7,769	--	West Germany 7,750; Hungary 19.
Metal:				
Scrap	32,191	22,305	--	Italy 8,298; West Germany 7,736; Switzerland 3,295.
Pig iron, cast iron, related materials	8,827	7,671	90	France 2,181; West Germany 1,457; Italy 891.
Ferroalloys, unspecified	r12,264	12,857	473	India 2,005; Italy 1,573; Romania 1,367.
Steel, primary forms	417,172	324,261	28,140	West Germany 165,736; Italy 42,742.
Semimanufactures:				
Bars, rods, angles, shapes, sections, thousand tons	395	339	5	West Germany 109; Italy 93; France 39.
Universals, plates, sheets do.	1,513	1,453	67	West Germany 424; U.S.S.R. 348; Italy 211.
Hoop and strip do.	184	181	1	West Germany 65; Switzerland 25; Italy 16.
Rails and accessories do.	123	63	(2)	Switzerland 27; Brazil 7; Algeria 5.
Wire do.	61	53	3	West Germany 24; Italy 7; Switzerland 5.
Tubes, pipes, fittings do.	508	416	11	U.S.S.R. 200; West Germany 65; Italy 21.
Castings and forgings, rough do.	17	12	(2)	West Germany 6; Netherlands 1; Switzerland 1.
Lead:				
Ore and concentrate	1,022	--		
Metal including alloys:				
Scrap	49	NA		
Unwrought	988	1,126	--	Yugoslavia 568; West Germany 425; Hungary 50.
Semimanufactures	23	68	--	West Germany 44; Tunisia 10; Denmark 8.
Mercury, 76-pound flasks	84	NA		
Nickel:				
Matte and speiss	3	56	--	All to Yugoslavia.
Metal including alloys:				
Scrap	295	NA		
Unwrought	66	29	--	West Germany 28.
Semimanufactures	1,641	821	36	West Germany 367; Switzerland 40; Yugoslavia 34.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, value, thousands	$3,467	$2,960	--	West Germany $2,186; United Kingdom $455; France $133.

See footnotes at end of table.

Table 2.—Austria: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Silver:				
Waste and sweepings value, thousands	$57	--		
Metal including alloys, unwrought and partly wrought ---do---	$7,361	$5,242	--	West Germany $3,143; Switzerland $783; Yugolavia $709.
Tin: Metal including alloys:				
Scrap	10	--		
Unwrought	17	17	--	West Germany 15; Yugoslavia 2.
Semimanufactures	4	(2)	--	Mainly to Switzerland.
Titanium: Oxides	523	NA		
Zinc:				
Blue powder	58	NA		
Metal including alloys:				
Scrap	1,123	NA		
Unwrought	4,371	4,035	--	Yugoslavia 2,072; Hungary 1,110; West Germany 709.
Semimanufactures	227	165	15	West Germany 96; Italy 17.
Other:				
Ores and concentrates	r1,023	754	37	West Germany 438; Poland 90; Israel 85.
Oxides and hydroxides	5,127	NA		
Ashes and residues	101,089	NA		
Base metal including alloys, all forms	r7,643	8,891	587	West Germany 3,433; United Kingdom 2,079; Italy 1,495.
Waste and sweepings of unspecified precious metals value, thousands	$3,992	$6,615	--	West Germany $5,656; France $857; United Kingdom $102.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	37	140	--	All to West Germany.
Artificial: Silicon carbide	92	NA		
Dust and powder of precious and semi-precious stones including diamond value, thousands	$110	$17	--	Switzerland $13; Philippines $3; Iraq $1.
Grinding and polishing wheels and stones	14,030	13,831	206	West Germany 2,472; Italy 1,516; France 1,012.
Asbestos, crude	1	9	--	All to Yugoslavia.
Barite and witherite	7	3	--	All to West Germany.
Boron materials:				
Crude natural borates	20	3	--	Do.
Oxides and acids	10	NA		
Cement	14,374	21,944	--	Hungary 11,193; West Germany 8,601; Italy 1,682.
Chalk	1,927	2,592	--	Hungary 1,586; Czechoslovakia 725; West Germany 132.
Clays, crude	60,608	74,655	10	Hungary 33,310; West Germany 32,539; Italy 5,856.
Diamond:				
Gem, not set or strung value, thousands	$134	$741	$308	Israel $328; Hungary $78.
Industrial stones ---do---	$80	$75	--	Hungary $65; Egypt $5; Belgium-Luxembourg $3.
Diatomite and other infusorial earth	2,471	2,203	--	Bulgaria 765; Yugoslavia 656; Hungary 464.
Feldspar, fluorspar, related materials	20	--		
Fertilizer materials:				
Crude, n.e.s	382	13,078	--	Czechoslovakia 12,745; Switzerland 288; Italy 15.
Manufactured	794,235	730,312	2	West Germany 416,146; Italy 70,613; East Germany 65,000.
Graphite, natural	11,826	10,284	67	West Germany 3,581; Poland 2,009; France 936.
Gypsum and plaster	141,461	119,295	--	West Germany 116,779; Italy 1,570; Hungary 572.
Lime	1,229	1,249	--	West Germany 1,054; Hungary 88; U.S.S.R. 76.
Magnesium compounds	154,806	138,304	3,146	West Germany 32,232; France 23,500; Venezuela 21,071.
Mica:				
Crude including splittings and waste	316	1,659	--	West Germany 747; Italy 483; France 96.
Worked including agglomerated splittings	274	247	(2)	West Germany 69; India 35; Yugoslavia 23.
Pigments, mineral:				
Natural, crude	7,611	NA		
Iron oxides and hydroxides, processed	2,702	NA		

See footnotes at end of table.

Table 2.—Austria: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Precious and semiprecious stones other than diamond:				
Natural ____ value, thousands	$375	$450	$3	West Germany $143; Switzerland $127; Israel $67.
Synthetic ____ do ____	$4,229	$6,428	$396	Egypt $1,847; Switzerland $923; West Germany $670.
Pyrite, unroasted	47	7	--	All to West Germany.
Salt and brine	1,506	1,621	--	West Germany 722; Hungary 519; Greece 207.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	20	NA		
Sulfate, manufactured	80,826	NA		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked ____	130,979	144,351	--	West Germany 100,984; Switzerland 41,990; Italy 1,049.
Worked	60,152	66,150	284	West Germany 57,400; Switzerland 7,910; Yugoslavia 347.
Dolomite, chiefly refractory-grade	24,943	29,569	--	West Germany 24,411; Venezuela 3,980; India 410.
Gravel and crushed rock	544,124	691,135	--	Switzerland 423,037; West Germany 240,271; Netherlands 10,173.
Limestone other than dimension	1,054	917	--	West Germany 849; Yugoslavia 63.
Quartz and quartzite	60	52	--	Yugoslavia 26; U.S.S.R. 15; Italy 9.
Sand other than metal-bearing ____	145,332	97,709	--	West Germany 62,593; Switzerland 32,624; Italy 1,625.
Sulfur:				
Elemental, crude including native and byproduct	139	419	--	Yugoslavia 410; West Germany 9.
Sulfuric acid	7,525	NA		
Talc, steatite, soapstone, pyrophyllite	110,150	113,369	--	West Germany 56,684; Italy 15,359; Switzerland 9,838.
Other:				
Crude	3,914	20,475	110	West Germany 14,227; United Kingdom 1,747; Italy 85.
Slag and dross, not metal-bearing	90,389	92,220	--	West Germany 87,878; Italy 2,692; Switzerland 1,547.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	14	2	--	Iraq 1.
Carbon black	18	NA		
Coal:				
Anthracite and bituminous	4	50	--	Greece 48; Switzerland 2.
Briquet of anthracite and bituminous coal	122	83	--	Switzerland 71; Yugoslavia 12.
Lignite including briquets	8,657	5,437	--	West Germany 5,368; Switzerland 69.
Coke and semicoke	4,526	5,107	--	West Germany 5,008; Switzerland 76; Egypt 23.
Peat including briquets and litter ____	11,779	10,580	--	Italy 7,927; West Germany 2,403; Greece 86.
Petroleum refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	371	49	(2)	Italy 30; Yugoslavia 13; Switzerland 6.
Gasoline ____ do ____	2,156	1,585	--	West Germany 1,584.
Mineral jelly and wax ____ do ____	99	130	--	Netherland 113; Switzerland 8; West Germany 2.
Kerosene and jet fuel ____ do ____	161	26	--	West Germany 21; Finland 2; Sweden 1.
Distillate fuel oil ____ do ____	264	164	--	West Germany 157; Yugoslavia 4; Romania 3.
Lubricants ____ do ____	554	430	--	Hungary 116; Czechoslovakia 115; Iran 40.
Residual fuel oil ____ do ____	2,529	1,383	--	Hungary 1,382.
Bitumen and other residues do ____	68	30	--	West Germany 17; Switzerland 4; Italy 3.
Bituminous mixtures ____ do ____	27	42	--	Algeria 19; Pakistan 14; West Germany 3.
Petroleum coke ____ do ____	--	1	--	All to Germany.

r Revised. NA Not available.
[1] Table prepared by Jozef Plachy.
[2] Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	46,342	312,800	539	West Germany 151,034; Hungary 68,562; France 60,489.
Oxides and hydroxides	303,515	NA		
Metal including alloys:				
Scrap	53,109	NA		
Unwrought	78,148	93,413	1	West Germany 49,479; Norway 17,958; Hungary 5,111.
Semimanufactures	54,591	54,559	30	West Germany 22,027; Switzerland 9,308; Italy 6,252.
Copper:				
Sulfate	1,059	NA		
Metal including alloys:				
Scrap	44,156	NA		
Unwrought	13,314	12,499	29	Republic of South Africa 4,763; West Germany 3,081; Zimbabwe 1,629.
Semimanufactures	74,207	77,504	39	West Germany 40,552; Italy 9,671; Belgium-Luxembourg 8,149.
Gold: Metal including alloys, unwrought and partly wrought, troy ounces	107,545	NA		
Iron and steel:				
Iron ore concentrate:				
Excluding roasted pyrite, thousand tons	3,684	3,201	(2)	U.S.S.R. 1,383; Sweden 738; Canada 467.
Pyrite, roasted, do	20	13	--	Yugoslavia 12.
Metal:				
Scrap	239,048	115,029	13	West Germany 49,770; U.S.S.R. 28,201; Czechoslovakia 26,495.
Pig iron, cast iron, related materials	55,413	43,815	20	Canada 14,211; U.S.S.R. 9,948; West Germany 9,156.
Ferroalloys, unspecified	r74,526	68,237	48	Yugoslavia 24,526; West Germany 10,915; Norway 10,882.
Steel, primary forms	147,356	230,101	1	Czechoslovakia 96,977; West Germany 51,298; Hungary 47,248.
Semimanufactures:				
Bars, rods, angles, shapes, sections	306,473	326,229	97	West Germany 108,303; Italy 96,954; France 25,660.
Universals, plates, sheets	252,974	280,380	45	West Germany 123,639; Belgium-Luxembourg 34,872; Italy 16,890.
Hoop and strip	95,191	98,820	13	West Germany 64,434; Italy 14,421; Switzerland 6,966.
Rails and accessories	3,147	2,734	--	West Germany 1,632; Switzerland 811; Belgium-Luxembourg 211.
Wire	38,320	36,617	15	West Germany 12,251; Belgium-Luxembourg 11,456; France 5,026.
Tubes, pipes, fittings	189,871	228,840	43	West Germany 107,320; Italy 55,042; East Germany 9,477.
Castings and forgings, rough	14,784	14,744	1	West Germany 11,500; Italy 807; Switzerland 598.
Lead:				
Ore and concentrate	3,987	4,124	--	Italy 2,635; Algeria 1,414; West Germany 75.
Metal including alloys:				
Scrap	6,745	NA		
Unwrought	37,501	38,516	151	West Germany 16,260; United Kingdom 6,414; Republic of South Africa 5,550.
Semimanufactures	1,056	997	(2)	West Germany 826; United Kingdom 141; Belgium-Luxembourg 19.
Manganese: Ore and concentrate, metallurgical-grade	666	437	--	Netherlands 423; West Germany 14.
Mercury, 76-pound flasks	189	NA		
Nickel:				
Ore and concentrate	22	--		
Matte and speiss	1,207	907	--	Netherlands 643; Canada 68; Australia 36.
Metal including alloys:				
Scrap	572	NA		
Unwrought	2,663	3,029	61	Republic of South Africa 929; U.S.S.R. 473; Canada 271.
Semimanufactures	1,690	679	27	West Germany 447; United Kingdom 63; France 50.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$4,291	$4,426	$1,242	West Germany $2,068; Belgium-Luxembourg $431.
Silver:				
Waste and sweepings[3] do	$3	$133	--	All from West Germany.
Metal including alloys, unwrought and partly wrought do	$31,284	$14,922	$8	West Germany $11,736; Switzerland $1,567; Yugoslavia $688.
Tin: Metal including alloys:				
Scrap	18	NA		
Unwrought	501	523	2	West Germany 257; Brazil 60; Indonesia 51.
Semimanufactures	144	152	(2)	West Germany 128; Belgium-Luxembourg 12; Netherlands 10.
Zinc:				
Ore and concentrate	10,793	10,133	--	All from Italy.
Blue powder	1,428	NA		
Metal including alloys:				
Scrap	198	NA		
Unwrought	8,686	11,433	--	West Germany 4,624; Belgium-Luxembourg 4,383; Netherlands 1,223.
Semimanufactures	2,256	4,091	(2)	West Germany 2,190; Belgium-Luxembourg 1,001; France 570.
Other:				
Ores and concentrates	r61,118	63,485	1,376	Republic of South Africa 44,688; West Germany 3,039; Turkey 2,299.
Oxides and hydroxides	20,140	NA		
Ashes and residues	150,036	NA		
Base metals including alloys, all forms	r7,151	19,014	1,124	U.S.S.R. 14,062; West Germany 904.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	294	622	10	West Germany 283; Italy 246; Spain 46.
Artificial:				
Corundum	13,443	NA		
Silicon carbide	2,988	NA		
Dust and powder of precious and semi-precious stones including diamond value, thousands	$7,595	$8,668	$7,845	Switzerland $403; Ireland $301.
Grinding and polishing wheels and stones	1,716	1,705	4	West Germany 786; Italy 293; Spain 186.
Asbestos, crude	21,595	15,148	3	Canada 8,979; U.S.S.R. 3,085; Zimbabwe 1,176.
Barite and witherite	5,034	9,067	--	Turkey 3,348; West Germany 2,198; Ireland 2,079.
Boron materials:				
Crude natural borates	18,339	17,862	3,123	Turkey 14,355; Italy 288.
Oxides and acids	561	NA		
Cement	56,927	88,551	--	Yugoslavia 32,587; Poland 19,659; Italy 13,245.
Chalk	9,580	12,000	--	Italy 8,751; West Germany 1,735; France 1,400.
Clays, crude	195,869	188,215	2,014	West Germany 70,533; Czechoslovakia 64,662; Brazil 23,707.
Cryolite and chiolite	206	204	--	Denmark 202; West Germany 2.
Diamond:				
Gem, not set or strung value, thousands	$2,854	$5,362	$41	Israel $2,794; Belgium-Luxembourg $981; India $466.
Industrial stones do	$493	$654	$13	West Germany $209; Hungary $120; Republic of South Africa $117.
Diatomite and other infusorial earth	12,931	14,271	1,290	Czechoslovakia 4,841; Hungary 2,938; Denmark 2,505.
Feldspar, fluorspar, related materials	17,564	NA		
Fertilizer materials:				
Crude, unspecified	r443,899	439,697	44,442	Algeria 114,951; Israel 92,324; Togo 88,654.
Manufactured:				
Ammonia	79,488	NA		
Unspecified and mixed	r648,724	651,679	7,930	West Germany 205,883; France 80,594; East Germany 79,359.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Graphite, natural	3,280	4,966	(2)	China 4,206; West Germany 242; India 100.
Gypsum and plaster	11,826	12,749	--	West Germany 12,141; Italy 414; France 80.
Lime	2,676	3,802	--	Yugoslavia 2,411; West Germany 668; Poland 361.
Magnesium compounds	150,270	122,064	1,030	Turkey 35,790; Italy 30,694; Mexico 10,908.
Mica:				
Crude including splittings and waste	321	183	1	West Germany 102; United Kingdom 50; Norway 23.
Worked including agglomerated splittings	225	226	(2)	France 108; Belgium-Luxembourg 43; India 42.
Pigments, mineral:				
Natural, crude	927	NA		
Iron oxides and hydroxides, processed	5,141	NA		
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$2,884	$3,121	$80	West Germany $1,465; Switzerland $275; India $268.
Synthetic do	$1,677	$2,531	$133	Switzerland $790; West Germany $634; U.S.S.R. $401.
Pyrite, unroasted	854	668	--	Italy 430; West Germany 184; Hungary 53.
Salt and brine	134	211	(2)	France 93; West Germany 74; Israel 34.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	2,499	NA		
Sulfate, manufactured	418	NA		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	40,357	43,003	17	Italy 23,536; Republic of South Africa 5,523; France 2,533.
Worked	56,499	61,319	2	Italy 43,584; West Germany 9,856; Yugoslavia 4,304.
Dolomite, chiefly refractory-grade	5,277	10,894	--	West Germany 9,820; Italy 684; Norway 191.
Gravel and crushed rock	216,420	204,855	--	West Germany 183,095; Italy 20,573; Czechoslovakia 501.
Limestone other than dimension	1,349	1,610	--	Yugoslavia 946; West Germany 663.
Quartz and quartzite	28,829	25,881	(2)	West Germany 13,379; Hungary 10,774; Norway 789.
Sand other than metal-bearing	407,812	366,563	3	West Germany 183,730; Czechoslovakia 163,423; East Germany 8,950.
Sulfur:				
Elemental:				
Crude including native and byproduct	98,589	90,590	--	Poland 38,528; West Germany 32,217; Hungary 18,020.
Colloidal, precipitated, sublimed	336	NA		
Sulfuric acid	33,002	NA		
Talc, steatite, soapstone, pyrophyllite	2,732	6,198	(2)	India 3,000; France 2,373; Norway 505.
Other:				
Crude	87,514	72,967	2,383	West Germany 26,654; Hungary 24,462; Czechoslovakia 5,262.
Slag and dross, not metal-bearing	47,967	41,900	--	Italy 24,240; West Germany 12,008; Yugoslavia 3,643.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	3,319	2,654	81	Trinidad and Tobago 2,135; Hungary 276; West Germany 144.
Carbon black value, thousands	$19,567	NA		
Coal:				
Anthracite and bituminous thousand tons	3,577	3,731	531	Poland 1,641; U.S.S.R. 680; Czechoslovakia 602.
Briquets of anthracite and bituminous coal do	21	22	--	West Germany 21.
Lignite including briquets do	827	686	--	East Germany 328; West Germany 218; Yugoslavia 130.
Coke and semicoke do	1,274	889	--	Czechoslovakia 306; West Germany 256; Poland 146.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Gas, natural: Gaseous million cubic feet	148,331	NA		
Peat including briquets and litter	59,448	62,687	--	West Germany 46,429; U.S.S.R. 9,630; Poland 3,452.
Petroleum:				
Crude thousand 42-gallon barrels	38,435	45,244	--	Libya 16,092; Algeria 6,433; Nigeria 5,425.
Refinery products:				
Liquefied petroleum gas do	1,793	NA		
Gasoline do	4,887	4,522	--	Italy 2,238; West Germany 1,325; Hungary 592.
Mineral jelly and wax do	110	123	(2)	West Germany 50; Hungary 26; Czechoslovakia 20.
Kerosene and jet fuel do	908	754	(2)	Hungary 503; Czechoslovakia 130; West Germany 69.
Distillate fuel oil do	3,758	3,368	(2)	Hungary 1,858; West Germany 635; Yugoslavia 316.
Lubricants do	3,436	5,402	6	Hungary 2,242; Czechoslovakia 1,094; U.S.S.R. 1,033.
Residual fuel oil do	5,883	7,399	--	West Germany 2,777; Czechoslovakia 2,701; Yugoslavia 1,436.
Bitumen and other residues do	1,827	1,981	--	West Germany 719; Yugoslavia 551; Hungary 280.
Bituminous mixtures do	30	32	(2)	West Germany 23; Netherlands 4; Italy 3.
Petroleum coke do	492	484	88	West Germany 323; United Kingdom 27.

[r]Revised. NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

COMMODITY REVIEW

METALS

Aluminum.—Austria Metall AG and Pechiney of France signed an agreement with CVG Alcasa of Venezuela to construct a 150,000-ton-per-year aluminum smelter at Puerto Ordaz, Venezuela. The plant was expected to be operational by 1990. Austria Metall withdrew from another aluminum project, Aluminio de Sur S.A. (Alusur), in which it had a 49% interest. The Venezuelan wire-rod producer Suramericana de Aleaciones Laminados (Sural) was to look for other potential partners. The smelter was scheduled to start up in early 1990.

Iron and Steel.—Voest-Alpine AG, Midrex Corp. of the United States, and Siderúrgica Venezolana S.A. (Sivensa) signed a letter of intent in mid-1987 for construction of a direct-reduction iron plant in Venezuela. The plant, with an annual capacity of 400,000 tons of hot briquetted iron, was to be built near Puerto Ordaz. Production would be split almost evenly between domestic use and exports. OIAG, the state holding company, announced that Voest-Alpine was to be split into three separate operating groups covering steel, engineering, and plantmaking, with Voest-Alpine becoming a holding company with no particular operative functions.

Lead and Zinc.—Bleiberger Bergwerks-Union AG (BBU) operated a lead-zinc mine at Bleiberg-Kreuth. Economical mining of these metals required continuous research. The irregular metallization of the ore bodies required complex mining methods with high production and labor costs. The mine was the only producer of lead and zinc in the country and was owned by the Government.

Other Metals.—BBU operated Austria's antimony mine, in the state of Burgenland. The production of stibnite continued to decline, and the mine was expected to be in operation only a few more years. BBU was exploring two areas in Carinthia and Tyrol for gold. Both projects were being carried

out in cooperation with foreign mining companies. Wolfram Bergbau-und Hüttengesellschaft mbH's Westfield Mine at Mitterstill produced 288,000 tons of scheelite in 1987. The underground mine became operational in 1986 after the company closed its open pit operation at Ostfeld and was continuing to operate in the face of a very difficult market situation for tungsten.

INDUSTRIAL MINERALS

Cement.—The Austrian cement industry, with 13 companies, operated at about 60% of capacity in 1987. Some cement plants have been making modifications to their operations, mainly to increase production but also to reduce the emission of pollutants.

The portland cement plant of Gebr. Leube Gartenan was to raise the capacity of its kiln line No. 2 from 820 to 1,050 tons per day. The other line was to shut down when the modification was completed. Perlmooser Cement Co. added a Polysius high-efficiency separator to its operations at Mannersdorf.

Lithium.—BBU took over the mining rights to the Koralpe lithium project from Mineral-Exploration GmbH (Minerex) in early 1987. The underground exploration and economic feasibility study was completed. Although the results were encouraging, the project was temporarily postponed because of the market situation and the weak dollar.

Other Industrial Minerals.—Veitscher Magnesitwerke AG was to invest an estimated $4 million[2] in its Breitenau facility to raise annual production of high-purity caustic magnesia (MgO) to 7,000 tons. The expansion program was to permit converting the MgO into high-purity (99.9%) magnesium hydroxide. Chemie-Linz AG awarded a contract to Uhde GmbH to design and construct a 1,600-ton-per-day nitrophosphate plant at Linz. Byproducts of the nitrophosphate process, such as ammonium nitrate and lime, were to be processed at the plant.

Talkumwerke Naintsch GmbH (TN) had three talc mines and plants, all in Styria. One 100,000-ton-per-year open pit talc operation was at Rahenwald. The underground operation at Lassing produced about 20,000 tons per year of a white dolomite talc. The underground operation near Weisskirchen produced about 20,000 tons per year of a polyminerallic talc product containing chlorite, quartz, and mica. TN specialized in supplying micrograde talc for the paper, pulp, and paint industries and granular talc for the roofing industry. About 85% of production was exported.

MINERAL FUELS

Austria's energy situation was characterized by declining domestic production of fossil fuels and growing dependence on imported energy. Hydropower was the main indigenous energy source, covering more than 25% of tons of oil equivalent and more than 70% of Austrian electricity generation. Opposition to the construction of thermal electric plants for environmental reasons increased considerably in recent years. As a result, in 1987, two hydroelectric power stations, Wildungsmauer (245 megawatts) and Wolfsthal II (181 megawatts) were recommended. These plants were to be an alternative to the disputed Hainburg hydroelectric power project (360 megawatts) on the Danube River. The Wolfsthal project could only be realized in cooperation with Czechoslovakia. In addition to the above mentioned projects, there were about 45 hydroelectric projects (10 megawatts or larger) in the planning stage. These plans were in line with the policy objective of the Austrian Government to expand the exploitation of the country's hydropower potential.

Coal.—Prospecting and exploration for coal was supported by public funds. As a result, newly discovered reserves in recent years have replaced the coal that was produced. The Federal Government's financial support for coal mining has been reduced considerably in recent years to $2.1 million in 1987. Of this amount, 54% was allocated for prospecting and exploration and 24% each for development and social programs and the shutdown of mines. At yearend 1986, all categories of coal reserves, almost exclusively brown coal, were estimated at about 500 million tons, of which 10% was considered to be economic.

Brown coal was mined near Koflach in the West Styrian mining area, in upper Austria from the Trimmelkam deposit, and in the region of the Hausruck Range at Ampflwang. The coal was mined from both underground and open pit mines. Open pit mining operations were difficult because of the location of the mines in mountainous terrain and also because of the proximity to existing commercial and residential development. The largest consumer of brown coal in Austria was the electric power industry, which used about 70% of this energy source.

Wolfsegg-Traunthaler Kohlenwerke AG (WTK) completed construction of its washery plant in early 1987. However, operational problems delayed startup of the plant. WTK was considering construction of a second plant using a dry separation process to handle 20 millimeter-size fractions that cannot be treated in the washery plant. Graz-Köflacher Eisenbahn-und Bergbau Gesellschaft (GKB) was also considering construction of a dry separation processing plant to beneficiate part of the production from GKB's open pit mines.

Natural Gas.—Austria's proven natural gas reserves were estimated to be about 9 billion cubic meters at yearend 1986. These reserves were expected to produce at a declining rate for another 25 years. Production of natural gas, roughly 1.1 billion cubic meters per year, cannot be expanded more than marginally in the future. Natural gas was produced by OMV Aktiengesellschaft, accounting for 60% of production, and Rohol-Aufsuchungs GmbH (RAG), 40% of production. OMV was a state-owned company and RAG was owned equally by Mobil Oil Austria AG and Shell Austria AG. About 95% of gas imports was handled by OMV.

The first phase of the trans-Austrian pipeline (TAG) II was completed in 1987. This increased Austria's capacity for transshipment of Soviet natural gas to Western Europe from 14 to 17 billion cubic meters per year. By October 1988, capacity was expected to reach 20 billion cubic meters. In addition to TAG, Austria has the capacity to transship approximately 4.3 billion cubic meters of gas annually to France via the West-Austria-Gasleitung (WAG) pipeline. In light of Austria's role as an energy transit country, the Government was interested in seeing further construction of transit pipelines with foreign partners.

Petroleum.—Under a privatization law passed in July 1987, Österreichische Mineralölverwaltungs AG (OeMV), the state oil company, would be listed on the Vienna stock exchange and a 25% stake, worth about $190 million, would be offered to sale to investors. An unspecified percentage would also be offered foreign investors. Austria's only refinery in Schwechat near Vienna, with a capacity of 302,000 barrels per day, had about an 80% capacity utilization rate. The refinery was supplied with imported crude oil by a single pipeline from Italy.

Proven and probable reserves of petroleum declined to an estimated 110 million barrels at yearend 1986. The fall in oil prices has pushed down investments for exploration and prospecting. However, the Government reached a 5-year agreement with the producing companies to keep activities at a minimum level.

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[1]Physical scientists, Division of International Minerals.
[2]Values have been converted from Austrian schillings (S) to U.S. dollars at the rate of S12.5=US$1.00, the average rate in 1987.

The Mineral Industry of Belgium-Luxembourg

By John G. Panulas[1]

BELGIUM

In 1987, Belgium's terms of trade improved 7.5%, largely the result of the declining value of the U.S. dollar and falling oil prices. The country also enjoyed gross national product (GNP) growth of 2.3%, with its current trade account surplus amounting to 2.6% of the GNP. Industrial production remained unchanged from that of the previous year; however, unemployment fell 1% from the 1986 level of 12.2%.

The focal point of Belgium's economic program was continued reduction of the country's budget deficit, from 14.3% of the GNP in 1981 to 8.2% of the GNP in 1987. The Government's austerity package involved savings of $5.3 billion[2] throughout 1987. Notable, however, was the Government's indication that, because of political problems that would ensue, it was no longer feasible to further cut the budget. Consequently, the Government initiated a privatization program.

The program would reduce the Government's quasi-monopoly position in certain industries, particularly gas and steel. Targeted for privatization was Distrigaz, the Belgium gas importer and distributor. As to the steel sector of the economy, it was said Belgian steelmakers would not be prepared for privatization until the 1990's, when results of steel industry restructuring could be determined. Of specific concern was the ability of steel companies to maintain profitability in a cyclical market environment and, in turn, to make the industry attractive to the private capital required to maintain competitiveness.

PRODUCTION

Although Belgium remained dependent on foreign sources of raw material, the country continued to be a leading producer of cobaltiferous materials, germanium, and selenium. It also ranked high in the smelter production of cadmium, copper, indium, lead, silver, steel, tellurium, and zinc.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[p]
METALS					
Aluminum	5,784	5,712	3,908	5,196	e5,200
Arsenic, white[e]	3,000	3,000	3,000	3,000	3,500
Cadmium, smelter	1,260	1,476	1,252	1,374	e1,300
Copper:					
Blister:[e]					
Primary	2,800	500	900	2,000	900
Secondary	70,500	75,500	114,200	106,000	75,500
Total	73,300	76,000	115,100	108,000	76,400
Refined, primary and secondary, including alloys	431,268	427,704	455,459	457,779	407,500
Iron and steel:					
Pig iron thousand tons	8,028	8,964	8,719	8,048	e8,000
Ferroalloys: Electric-furnace ferromanganese[e] do	87	95	90	87	90
Steel:					
Crude do	10,157	11,303	10,683	9,770	e9,700
Semimanufactures do	7,056	8,136	8,072	7,358	e9,700
Lead:					
Smelter:[e]					
Primary[3]	54,400	71,500	67,000	70,000	70,000
Secondary[4]	30,000	30,000	8,300	10,000	10,000
Total	84,400	101,500	75,300	80,000	80,000
Refined:					
Primary	96,300	89,600	84,293	64,000	e63,000
Secondary	37,848	38,116	30,000	e26,000	e26,000
Total[5]	134,148	127,716	114,293	90,000	e89,000
Selenium[e]	60	65	65	70	70
Tin: Secondary	2,220	2,408	2,298	2,712	e2,700
Zinc:					
Slab:					
Primary	262,600	270,700	271,400	268,600	284,500
Secondary (remelted zinc)	13,244	14,624	18,162	e21,000	22,000
Total	275,844	285,324	289,562	289,600	306,500
Powder	25,104	29,652	32,568	32,194	33,155
Other, nonferrous: Precious metals, unworked, n.e.s.[e] thousand troy ounces	37,152	40,815	41,123	40,736	e40,000
INDUSTRIAL MINERALS					
Barite[e]	39,900	39,000	40,000	40,000	40,000
Cement, hydraulic thousand tons	5,719	5,715	5,537	5,688	e5,800
Clays: Kaolin do	60	69	37	40	45
Lime and dead-burned dolomite:					
Quicklime do	1,596	1,980	1,812	1,764	1,900
Dead-burned dolomite do	174	190	--	--	--
Nitrogen: N content of ammonia do	449	452	387	e350	400
Phosphates: Thomas slag, gross weight do	250	254	143	r e150	175
Sodium compounds:					
Carbonate	259,764	409,344	446,484	e460,000	e450,000
Sulfate[e]	250,000	250,000	260,000	265,000	260,000
Stone, sand and gravel:					
Calcareous:					
Dolomite thousand tons	2,713	2,982	3,210	3,988	3,678
Limestone do	22,044	20,520	20,502	21,275	23,237
Marble:					
In blocks cubic meters	1,332	3,624	684	1,107	700
Crushed and other	108	108	84	84	80
Petit granite (Belgian bluestone):					
Quarried thousand cubic meters	507	677	563	452	508
Sawed do	48	49	41	48	53
Worked do	9	15	e8	11	12
Crushed and other do	545	768	588	444	412
Porphyry, all types thousand tons	4,166	3,315	3,413	3,308	3,271
Quartz and quartzite	469,720	349,720	266,839	e275,000	e280,000
Sandstone:					
Rough stone including crushed thousand tons	1,962	2,436	1,864	1,972	1,950
Paving	12,444	7,596	10,224	9,798	e8,900

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[p]
INDUSTRIAL MINERALS —Continued					
Stone, sand and gravel —Continued					
Sandstone —Continued					
Sand and gravel:					
Construction sand ____ thousand tons	6,768	6,636	6,576	6,334	7,452
Foundry sand ____ do ____	540	612	624	551	588
Dredged sand ____ do ____	1,368	1,127	1,235	909	918
Glass sand ____ do ____	1,668	1,680	1,392	1,519	1,675
Other sand ____ do ____	1,644	1,452	1,836	2,043	2,403
Gravel, dredged ____ do ____	4,788	5,340	5,820	4,862	6,163
Sulfur, byproduct:[e]					
Elemental ____ do ____	105	105	100	110	105
Other forms ____ do ____	145	135	150	150	145
Total ____ do ____	250	240	250	260	250
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[e] ____	2,000	1,750	1,700	1,800	1,800
Coal:					
Anthracite ____ thousand tons	187	340	--	--	--
Bituminous ____ do ____	5,909	5,960	6,211	5,590	4,357
Total ____ do ____	6,096	6,300	6,211	5,590	4,357
Coke, all types ____ do ____	5,112	5,928	5,964	5,130	5,500
Fuel briquets, all kinds ____ do ____	46	24	28	--	--
Gas:					
Manufactured ____ million cubic feet	21,989	25,337	25,272	22,473	[e]23,000
Natural ____ do ____	817	1,648	1,847	[e]1,500	[e]1,600
Petroleum refinery products:					
Gasoline ____ thousand 42-gallon barrels	33,514	31,527	32,749	34,753	[e]40,400
Jet fuel ____ do ____	11,333	9,782	9,879	10,352	[e]10,500
Kerosene ____ do ____	279	54	171	746	[e]350
Distillate fuel oil ____ do ____	56,271	59,889	54,727	57,933	[e]64,900
Residual fuel oil ____ do ____	30,616	35,208	24,230	40,605	[e]48,800
Lubricants ____ do ____	252	260	(7)	(7)	(7)
Other ____ do ____	15,479	14,560	12,315	16,948	[e]15,000
Refinery fuel and losses ____ do ____	10,690	7,580	8,992	[e]9,750	[e]8,000
Total ____ do ____	158,434	158,860	143,063	171,087	[e]187,950

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

[1]Table includes data available through June 24, 1988.

[2]In addition to the commodities listed, Belgium produced a number of other metals for which only aggregate output figures were available.

[3]Data not reported; derived by taking reported primary lead output, plus exports of lead bullion, minus imports of lead bullion.

[4]Data represent secondary refined lead output minus remelted lead; as such, the figures are probably high because they include some lead that was sufficiently pure as scrap that it did not require resmelting, but data are not adequate to permit differentiation.

[5]Includes remelted lead as follows, in metric tons: 1983—7,900; 1984—8,100; 1985—8,800; 1986—9,100; and 1987—9,000.

[6]Known to include gold, platinum-group metals, and silver.

[7]Included with "Petroleum refinery products: Other."

TRADE

The value of Belgium's crude nonfuel minerals exports amounted to 40% of the value of its imports of the same commodities. The value of mineral fuels, lubricants, and related materials taken in by the country was more than twice that exported.

Much of what Belgium imported was reexported, usually with value added. Reexportation of the country's minerals and metals was greatly facilitated through the use of Belgium's North Sea ports at Antwerp, Ghent, and Zeebrugge.

France, the Federal Republic of Germany, and the Netherlands continued to be Belgium's major partners in the minerals commodity trade.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	33	8	--	Netherlands 6; West Germany 2.
Alkaline-earth metals	150	78	--	West Germany 53; Italy 14; France 10.
Aluminum:				
Ore and concentrate	1,992	2,873	--	France 2,676; West Germany 197.
Oxides and hydroxides	1,353	1,237	--	France 505; United Kingdom 397; Netherlands 181.
Ash and residue containing aluminum	8,032	10,896	--	West Germany 4,096; Netherlands 3,801; Spain 1,903.
Metal including alloys:				
Scrap	46,950	51,888	17	France 18,111; Netherlands 14,095; West Germany 11,994.
Unwrought	23,036	24,861	--	West Germany 10,483; France 4,503; Netherlands 3,872.
Semimanufactures	283,087	287,594	28,403	France 62,882; West Germany 51,903; Netherlands 32,497.
Antimony:				
Ore and concentrate	5	49	--	France 48; Syria 1.
Metal including alloys, all forms	2	17	--	France 11; Italy 4; Tunisia 2.
Beryllium: Metal including alloys, all forms	10	4	--	United Kingdom 3; France 1.
Cadmium: Metal including alloys, all forms	804	633	(2)	France 394; West Germany 115; Spain 40.
Chromium:				
Ore and concentrate	36	(2)	--	All to Zaire.
Oxides and hydroxides	43	128	--	West Germany 96; Italy 22; Indonesia 5.
Metal including alloys, all forms	300	121	(2)	West Germany 84; France 23; Italy 5.
Cobalt:				
Ore and concentrate	1	1	--	All to Canada.
Metal including alloys	68	58	(2)	France 15; Italy 12; West Germany 9.
Columbium and tantalum:				
Ore and concentrate	--	1	--	All to West Germany.
Ash and residue containing columbium and/or tantalum	518	858	--	West Germany 848; Netherlands 10.
Metal including alloys, all forms:				
Columbium (niobium)	r5	(2)	--	All to Netherlands.
Tantalum	(2)	48	(2)	Italy 44; Austria 2; West Germany 1.
Copper:				
Ore and concentrate	532	573	--	Netherlands 304; West Germany 82; France 76.
Matte and speiss including cement copper	664	76	--	All to Spain.
Oxides and hydroxides	1,614	1,596	38	West Germany 727; France 189; Cuba 122.
Sulfate	6,723	6,588	NA	NA.
Ash and residue containing copper	1,271	1,261	--	France 888; West Germany 139; Netherlands 97.
Metal including alloys:				
Scrap	30,411	26,121	36	Netherlands 10,683; West Germany 8,444; France 4,084.
Unwrought	217,208	243,185	717	France 95,974; West Germany 46,298; Italy 32,395.
Semimanufactures	282,317	277,828	831	West Germany 102,711; France 54,389; Netherlands 34,629.
Gold:				
Waste and sweepings value, thousands	$3,890	$4,955	--	Netherlands $4,031; France $646; United Kingdom $266.
Metal including alloys, unwrought and partly wrought ---do---	$287,822	$216,644	$72,651	Switzerland $39,784; France $38,178.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	15,263	1,058	--	West Germany 389; France 347; Netherlands 114.
Pyrite, roasted	153,750	149,628	--	Spain 108,103; West Germany 17,734; France 14,601.
Metal:				
Scrap	736,458	658,309	41	West Germany 155,223; Netherlands 133,651; France 133,387.
Pig iron, cast iron, related materials	9,631	10,690	27	Netherlands 5,795; France 3,250; West Germany 694.

See footnotes at end of table.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Ferroalloys:				
Ferrochromium	1,338	876	--	West Germany 395; France 375; Spain 80.
Ferromanganese	20,557	17,370	--	France 7,769; West Germany 7,173; Pakistan 644.
Ferromolybdenum	17,282	16,545	NA	NA.
Ferronickel	324	103	--	West Germany 89; Netherlands 12; Sweden 1.
Ferrosilicochromium	97	--		
Ferrosilicon	368	900	--	West Germany 645; France 214; Netherlands 27.
Silicon metal	62	64	2	France 47; Japan 15.
Unspecified	2,541	2,619	--	West Germany 1,292; France 507; Italy 402.
Steel, primary forms thousand tons	3,151	2,907	109	France 1,152; West Germany 682; Italy 500.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	3,141	2,834	352	West Germany 730; France 500; Netherlands 390.
Universals, plates, sheets do	4,919	4,680	261	France 1,058; West Germany 979; Netherlands 468.
Hoop and strip do	508	484	2	West Germany 243; France 90; Netherlands 57.
Rails and accessories do	105	116	12	France 23; China 12.
Wire do	294	290	43	West Germany 63; France 47.
Tubes, pipes, fittings do	616	453	21	U.S.S.R. 160; West Germany 63; Netherlands 57.
Castings and forgings, rough do	15	13	(2)	Netherlands 4; France 3; West Germany 2.
Lead:				
Ore and concentrate	--	29	--	France 24; West Germany 3; Netherlands 2.
Oxides	5,511	5,574	--	West Germany 4,017; Netherlands 656; Egypt 340.
Ash and residue containing lead	4,517	3,839	--	United Kingdom 1,464; West Germany 1,431; France 748.
Metal including alloys:				
Scrap	8,555	7,445	--	France 4,494; Netherlands 2,277; West Germany 534.
Unwrought	70,573	58,061	2	West Germany 18,645; Netherlands 16,179; France 7,277.
Semimanufactures	20,295	24,235	53	Netherlands 7,841; United Kingdom 5,462; France 5,021.
Lithium:				
Oxides and hydroxides	54	50	--	All to Haiti.
Metal including alloys, all forms	(2)	--		
Magnesium: Metal including alloys:				
Scrap	3,201	598	--	West Germany 299; United Kingdom 147; Italy 73.
Unwrought	48	52	--	West Germany 44; Italy 8.
Semimanufactures	65	3,300	--	West Germany 2,214; United Kingdom 947; France 95.
Manganese:				
Ore and concentrate, metallurgical-grade	492	878	19	West Germany 569; France 266.
Metal including alloys, all forms	1,327	1,960	--	West Germany 1,251; Norway 332; Sweden 53.
Mercury 76-pound flasks	287	319	--	Netherlands 203; Jordan 87; United Kingdom 29.
Molybdenum:				
Ore and concentrate	11,412	11,346	128	West Germany 3,776; United Kingdom 2,833; France 1,410.
Oxides and hydroxides	42	36	--	United Kingdom 35; West Germany 1.
Metal including alloys:				
Scrap	4	1	--	Mainly to West Germany.
Unwrought	22	13	--	West Germany 10; Netherlands 1; United Kingdom 1.
Semimanufactures	87	127	--	Netherlands 106; France 9; United Kingdom 8.

See footnotes at end of table.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Nickel:				
Oxides and hydroxides	2	12	--	All to West Germany.
Ash and residue containing nickel	3,578	2,276	20	East Germany 903; Canada 471; Austria 469.
Metal including alloys:				
Scrap	1,139	739	124	Netherlands 241; West Germany 200.
Unwrought	218	313	--	United Kingdom 71; West Germany 61; Austria 52.
Semimanufactures	1,103	411	1	West Germany 253; United Kingdom 52; France 37.
Platinum-group metals:				
Waste and sweepings value, thousands	$3,524	$6,387	$167	United Kingdom $2,547; West Germany $2,484; Switzerland $1,076.
Metals including alloys, unwrought and partly wrought do	$50,892	$100,231	$61,023	United Kingdom $11,414; Japan $8,290.
Rare-earth metals including alloys, all forms	--	1	1	
Rhenium: Metal including alloys, all forms	(2)	21	--	All to West Germany.
Silicon, high-purity	44	1	--	All to France.
Silver:				
Ore and concentrate[3] value, thousands	--	$5	--	NA.
Waste and sweepings do	$1,775	$2,610	--	West Germany $1,459; Netherlands $789; United Kingdom $275.
Metal including alloys, unwrought and partly wrought thousand troy ounces	37,713	41,636	14,564	United Kingdom 19,001; West Germany 1,929.
Tellurium and arsenic, elemental	53	53	(2)	United Kingdom 29; West Germany 19; Netherlands 3.
Tin:				
Ore and concentrate	36	26	--	France 25; Malaysia 1.
Oxides	1	(2)	(2)	
Ash and residue containing tin	3,072	2,147	--	United Kingdom 1,991; West Germany 150; Netherlands 6.
Metal including alloys:				
Scrap	68	84	--	Netherlands 42; West Germany 30; United Kingdom 6.
Unwrought	2,528	3,237	--	Netherlands 894; France 850; Denmark 703.
Semimanufactures	618	147	--	Italy 54; Switzerland 17; Iraq 15.
Titanium:				
Ore and concentrate	6	3	--	All to Italy.
Oxides	44,089	44,601	14,737	West Germany 9,194; Italy 2,270.
Metal including alloys:				
Scrap	22	14	--	West Germany 11; United Kingdom 3.
Unwrought	41	9	--	France 5; Canada 3.
Semimanufactures	109	85	(2)	West Germany 22; United Kingdom 16; France 11.
Tungsten:				
Ash and residue containing tungsten	4	--		
Metal including alloys:				
Scrap	112	41	--	West Germany 38; China 1; United Kingdom 1.
Unwrought	16	6	--	Philippines 2; Brazil 1; Netherlands 1.
Semimanufactures	125	105	--	Netherlands 72; United Kingdom 22; West Germany 8.
Uranium and/or thorium:				
Ore and concentrate	203	--		
Oxides and other compounds value, thousands	$75	--		
Vanadium:				
Oxides and hydroxides	451	465	42	France 310; Canada 41.
Ash and residue containing vanadium	4,685	7,631	--	Sweden 3,688; West Germany 2,068; Netherlands 1,875.
Metal including alloys:				
Unwrought	327	95	--	West Germany 34; Italy 31; France 30.
Semimanufactures	10	(2)	--	All to France.

See footnotes at end of table.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Zinc:				
Ore and concentrate	17,433	11,086	--	France 9,439; West Germany 1,620; Netherlands 27.
Oxides	7,563	6,926	--	France 3,410; West Germany 1,891; Italy 828.
Blue powder	18,063	18,933	--	West Germany 13,333; Switzerland 2,877; France 2,775.
Matte	5,057	4,491	--	France 1,479; West Germany 979; Netherlands 897.
Ash and residue containing zinc	35,928	62,270	--	Netherlands 26,830; France 23,543; West Germany 7,462.
Metal including alloys:				
Scrap	12,302	10,155	--	Netherlands 4,242; France 3,008; West Germany 2,341.
Unwrought	189,509	185,933	5,183	West Germany 64,037; France 28,128; Italy 11,780.
Semimanufactures	9,525	7,489	97	West Germany 5,002; Netherlands 1,229; France 425.
Zirconium:				
Ore and concentrate	102	--		
Metal including alloys:				
Scrap	--	(2)	--	All to West Germany.
Unwrought	4	4	--	Switzerland 2; France 1; West Germany 1.
Semimanufactures	2	10	1	Netherlands 5; West Germany 3; France 1.
Other:				
Ores and concentrates	48	115	--	Spain 63; France 28; Sweden 24.
Oxides and hydroxides	5	2,144	332	West Germany 611; Italy 398; France 376.
Ashes and residues	5,123	6,392	344	Netherlands 3,311; France 1,733; West Germany 859.
Base metals including alloys, all forms	r31	33	11	Japan 12; United Kingdom 5; West Germany 3.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	5,465	5,846	--	Netherlands 5,730; France 36; Republic of South Africa 31.
Artificial:				
Corundum	1,192	1,854	4	West Germany 977; France 445; Netherlands 287.
Silicon carbide	3,046	2,795	--	France 1,360; West Germany 684; Italy 621.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$8,352	$9,552	$1,619	Netherlands $1,021; West Germany $777.
Grinding and polishing wheels and stones	2,946	2,708	33	France 1,573; United Kingdom 240; West Germany 229.
Asbestos, crude	254	659	--	Netherlands 205; United Kingdom 199; West Germany 112.
Barite and witherite	86,620	55,379	--	West Germany 27,583; Netherlands 17,138; France 10,602.
Boron materials:				
Crude natural borates	24,903	22,453	(2)	Netherlands 11,190; West Germany 8,509; Denmark 557.
Elemental	(2)	1	--	All to Netherlands.
Oxides and acids	146	305	--	France 94; West Germany 58; Netherlands 36.
Bromine	--	5	--	All to Israel.
Cement thousand tons	2,591	2,678	10	Netherlands 1,495; West Germany 521; France 329.
Chalk	74,600	72,344	--	West Germany 24,738; Netherlands 15,269; Saudi Arabia 9,959.
Clays, crude:				
Bentonite	2,041	280	--	Italy 136; France 99; Netherlands 15.
Chamotte earth	213	198	--	West Germany 170; United Kingdom 19; France 6.
Fuller's earth	482	661	--	Netherlands 636; France 25.
Kaolin	38,642	37,002	--	Netherlands 18,505; West Germany 11,532; France 5,052.
Unspecified	3,384	6,863	--	France 3,784; Netherlands 2,831; West Germany 218.
Cryolite and chiolite	80	3	--	All to Argentina.
Diamond:				
Gem, not set or strung value, thousands	$3,186,310	$3,958,149	$954,742	Israel $708,221; India $659,873.
Industrial stones do	$73,765	$69,029	$12,972	West Germany $7,096; United Kingdom $6,521.
Diatomite and other infusorial earth	107,661	129,068	--	Netherlands 128,090; Cameroon 237; Spain 209.

See footnotes at end of table.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Feldspar, fluorspar, related materials:				
Feldspar	3	57	--	Norway 35; France 22.
Fluorspar	237	20	--	All to West Germany.
Unspecified	1	28	--	France 3; unspecified 25.
Fertilizer materials:				
Crude, n.e.s	45,329	42,072	--	Netherlands 20,199; France 18,829; West Germany 2,870.
Manufactured:				
Ammonia	40,286	55,267	--	France 37,991; West Germany 11,981; Netherlands 3,998.
Nitrogenous -- thousand tons	2,245	2,398	55	France 994; West Germany 379; Netherlands 281.
Phosphatic ---do---	733	717	--	West Germany 398; France 220; Netherlands 37.
Potassic ---do---	20	35	--	Netherlands 16; France 14; West Germany 2.
Unspecified and mixed --do---	1,875	1,847	4	France 948; West Germany 163; United Kingdom 97.
Graphite, natural	74	83	--	Mexico 27; France 26; Australia 14.
Gypsum and plaster	11,913	94,204	--	Netherlands 82,158; West Germany 8,250; France 2,015.
Iodine	66	26	--	Romania 16; Italy 3; Vietnam 3.
Kyanite and related materials	21	38	--	West Germany 20; France 18.
Lime	719,387	601,610	--	Netherlands 542,895; West Germany 29,712; France 7,458.
Magnesium compounds:				
Magnesite	282	154	--	All to Netherlands.
Oxides and hydroxides	4,231	4,922	--	France 3,905; West Germany 821; Netherlands 65.
Other	4,555	4,014	--	France 2,127; Netherlands 783; Ivory Coast 425.
Mica:				
Crude including splittings and waste	225	82	--	Netherlands 31; Romania 30; Italy 6.
Worked including agglomerated splittings	8	25	--	Netherlands 19; Republic of South Africa 3; France 1.
Nitrates, crude	13,596	17,416	--	Netherlands 8,913; West Germany 4,399; Italy 3,481.
Phosphates, crude	26,761	17,604	--	France 13,203; Netherlands 3,416; Suriname 597.
Phosphorus, elemental	(2)	(2)	--	All to Yugoslavia.
Pigments, mineral:				
Natural, crude	68	50	--	Ecuador 20; Philippines 10; United Kingdom 10.
Iron oxides and hydroxides, processed	11,006	13,932	50	West Germany 3,411; France 2,816; United Kingdom 1,928.
Potassium salts, crude	382	2,127	--	France 1,358; West Germany 593; Netherlands 176.
Precious and semiprecious stones other than diamond:				
Natural ----- value, thousands	$16,246	$18,579	$2,972	Sweden $3,407; Switzerland $2,992.
Synthetic ---do---	$2,113	$2,708	$174	Republic of Korea $719; Netherlands $615; Spain $406.
Pyrite, unroasted	46	125	--	All to Netherlands.
Salt and brine	205,256	164,860	23	Netherlands 78,212; France 76,784; Spain 5,732.
Sodium compounds, n.e.s.: Carbonate, manufactured	30,080	15,606	--	France 7,365; New Caledonia 2,900; West Germany 1,361.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked thousand tons	647	529	(2)	Netherlands 488; West Germany 21; France 18.
Worked ---do---	33	43	(2)	West Germany 26; Netherlands 8; France 5.
Dolomite, chiefly refractory-grade do---	1,238	1,431	--	Netherlands 761; West Germany 359; France 238.
Gravel and crushed rock ---do---	8,861	9,404	--	Netherlands 5,989; France 3,044; West Germany 369.

See footnotes at end of table.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel —Continued				
Limestone other than dimension thousands tons	809	917	--	Netherlands 516; France 208; West Germany 193.
Quartz and quartzite do	172	294	(2)	France 283; West Germany 6; Netherlands 3.
Sand other than metal-bearing do	3,801	3,789	(2)	Netherlands 1,709; France 1,100; West Germany 203.
Sulfur:				
Elemental:				
Crude including native and byproduct	7,511	16,903	--	Netherlands 11,689; West Germany 1,846; Brazil 1,027.
Colloidal, precipitated, sublimed	213	189	--	Mexico 110; Italy 29; Argentina 19.
Sulfuric acid	159,551	147,341	--	Netherlands 92,554; France 45,708; United Kingdom 3,171.
Talc, steatite, soapstone, pyrophyllite	41,241	39,929	158	United Kingdom 10,702; West Germany 7,543; France 4,317.
Vermiculite, perlite, chlorite	17,213	6,322	--	France 3,717; United Kingdom 2,416; West Germany 119.
Other:				
Crude thousand tons	919	351	(2)	Netherlands 324; France 20; West Germany 5.
Slag and dross, not metal-bearing do	2,109	2,248	24	France 765; Netherlands 626; West Germany 606.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	94,446	71,376	--	France 61,887; Netherlands 9,463; Zaire 12.
Carbon black	1,516	6,414	118	West Germany 2,773; Netherlands 2,175; France 491.
Coal:				
Anthracite thousand tons	70	86	--	France 37; United Kingdom 36; Netherlands 9.
Bituminous do	1,394	1,170	(2)	France 473; West Germany 321; Netherlands 205.
Briquets of anthracite and bituminous coal do	39	4	--	France 2; Switzerland 1.
Lignite including briquets do	26	33	--	Netherlands 22; France 10; United Kingdom 1.
Coke and semicoke do	759	550	--	West Germany 221; France 198; Austria 33.
Peat including briquets and litter	18,123	26,747	--	France 23,658; Netherlands 2,202; West Germany 259.
Petroleum:				
Crude thousand 42-gallon barrels	84	--		
Refinery products:				
Liquefied petroleum gas do	3,295	4,774	21	Netherlands 2,527; West Germany 697; United Kingdom 417.
Gasoline do	28,701	36,778	2,775	Netherlands 9,432; Switzerland 7,279; West Germany 7,076.
Mineral jelly and wax do	20	17	(2)	Nigeria 4; Australia 2; France 2.
Kerosene and jet fuel do	8,499	10,172	--	Netherlands 1,958; West Germany 1,951; bunkers 3,590.
Distillate fuel oil do	20,417	23,663	--	West Germany 9,989; Netherlands 3,924; France 3,239.
Lubricants do	2,557	2,597	1	Netherlands 629; West Germany 320; France 214.
Residual fuel oil do	32,116	48,956	2,709	Netherlands 11,160; West Germany 7,418; bunkers 12,334.
Bitumen and other residues do	1,777	2,506	--	France 631; West Germany 624; Netherlands 472.
Bituminous mixtures do	101	128	--	Netherlands 96; France 13; West Germany 5.
Petroleum coke do	537	427	--	France 293; Netherlands 87; West Germany 26.

rRevised. NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	895	200	20	West Germany 148; France 14.
Alkaline-earth metals	233	221	(2)	France 126; West Germany 54; U.S.S.R. 20.
Aluminum:				
Ore and concentrate	36,650	29,130	--	China 11,039; West Germany 7,853; Guyana 7,042.
Oxides and hydroxides	27,899	28,894	2,276	West Germany 22,448; Netherlands 2,566.
Ash and residue containing aluminum	16,575	9,134	39	West Germany 4,117; France 2,334; Italy 1,086.
Metal including alloys:				
Scrap	62,708	71,290	4,527	France 18,728; Netherlands 17,810; West Germany 15,694.
Unwrought	307,868	307,421	93	Netherlands 203,061; West Germany 23,399; France 18,396.
Semimanufactures	96,017	110,109	462	West Germany 40,372; France 24,017; Netherlands 18,505.
Antimony:				
Ore and concentrate	5,851	5,188	17	Bolivia 2,136; Turkey 1,200; China 626.
Oxides	811	810	9	France 494; China 153; United Kingdom 106.
Metal including alloys, all forms	215	385	--	Netherlands 268; China 62; U.S.S.R. 51.
Arsenic: Oxides and acids	22	20	2	France 11; United Kingdom 6.
Beryllium:				
Oxides and hydroxides	25	25	--	Brazil 24; West Germany 1.
Metal including alloys, all forms	(2)	1	(2)	Mainly from Netherlands.
Bismuth: Metal including alloys, all forms	23	3	--	United Kingdom 2; West Germany 1.
Cadmium: Metal including alloys, all forms	1,174	1,509	--	Netherlands 716; China 235; France 153.
Cesium and rubidium: Metal including alloys, all forms	3	(2)	--	All from West Germany.
Chromium:				
Ore and concentrate	5,231	3,846	--	Netherlands 3,659; Republic of South Africa 102; West Germany 59.
Oxides and hydroxides	1,026	787	(2)	West Germany 473; France 116; Netherlands 67.
Metal including alloys, all forms	456	536	(2)	France 219; China 143; United Kingdom 109.
Cobalt:				
Ore and concentrate	8	2	--	Mainly from United Kingdom.
Oxides and hydroxides	35	64	--	United Kingdom 33; Finland 27; Netherlands 3.
Metal including alloys, all forms	81	161	121	Ireland 17; Netherlands 10.
Columbium and tantalum:				
Ore and concentrate	1,949	2,046	50	Canada 1,996.
Ash and residue containing columbium and/or tantalum	--	1	--	All from United Kingdom.
Metal including alloys, all forms:				
Columbium (niobium)	13	6	2	Austria 3; West Germany 1.
Tantalum	21	40	17	West Germany 18; Austria 5.
Copper:				
Ore and concentrate	3,315	3,722	189	Peru 2,404; Australia 770.
Oxides and hydroxides	34	86	(2)	West Germany 57; Italy 23; Finland 4.
Sulfate	1,396	1,496	1	Netherlands 953; Italy 222; France 150.
Ash and residue containing copper	70,838	43,114	3,715	France 10,174; Chile 7,187; Sweden 4,270.
Metal including alloys:				
Scrap	152,480	119,423	3,949	France 29,866; United Kingdom 28,865; Netherlands 19,538.
Unwrought	421,483	464,095	2,035	Zaire 251,759; Zambia 41,741; Republic of South Africa 31,501.
Semimanufactures	46,668	50,069	187	West Germany 25,342; France 10,531; Italy 5,532.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Gold:				
Waste and sweepings value, thousands	$2,467	$2,647	$196	France $1,238; Netherlands $732; West Germany $363.
Metal including alloys, unwrought and partly wrought thousand troy ounces	2,101	1,640	NA	Switzerland 1,190; France 161; West Germany 129.
Hafnium: Metal including alloys, all forms	(2)	--		
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	18,997	18,056	--	Brazil 4,252; France 4,234; Sweden 2,774.
Pyrite, roasted do	1,576	52	--	West Germany 49; France 3.
Metal:				
Scrap do	1,490	1,222	21	West Germany 528; France 394; Netherlands 245.
Pig iron, cast iron, related materials	124,197	136,815	156	France 79,465; West Germany 16,042; Canada 11,953.
Ferroalloys:				
Ferrochromium	49,686	45,310	--	Zimbabwe 7,650; Netherlands 6,163; Albania 5,934.
Ferromanganese	56,037	47,343	132	France 15,955; Norway 12,986; West Germany 8,299.
Ferromolybdenum	591	709	--	United Kingdom 450; Netherlands 134; West Germany 100.
Ferronickel	7,239	5,243	--	Colombia 1,678; Dominican Republic 1,228; Greece 646.
Ferrosilicochromium	3,157	2,253	--	West Germany 2,059; Netherlands 102; Sweden 69.
Ferrosilicomanganese	30,594	41,049	3	Norway 21,599; Portugal 7,236; France 4,696.
Ferrosilicon	30,947	28,667	--	West Germany 10,016; Norway 8,335; France 4,443.
Silicon metal	559	873	(2)	France 304; Netherlands 277; West Germany 260.
Unspecified	4,030	4,612	20	France 2,428; West Germany 801; United Kingdom 551.
Steel, primary forms thousand tons	1,161	1,020	(2)	France 304; Netherlands 277; West Germany 260.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	916	956	1	France 276; West Germany 215; Netherlands 138.
Universals, plates, sheets do	892	995	(2)	Netherlands 338; France 207; West Germany 206.
Hoop and strip do	123	132	(2)	France 58; West Germany 52; Netherlands 7.
Rails and accessories do	7	5	(2)	West Germany 3; France 2.
Wire do	83	73	(2)	West Germany 39; Netherlands 15; France 7.
Tubes, pipes, fittings do	323	314	2	France 77; West Germany 75; Netherlands 61.
Castings and forgings, rough do	58	55	3	West Germany 22; France 17; Netherlands 6.
Lead:				
Ore and concentrate	114,697	76,144	--	Peru 30,348; Australia 18,003; Greece 10,002.
Oxides	5,387	7,280	3	France 4,255; West Germany 2,839; Netherlands 183.
Ash and residue containing lead	54,903	41,369	1,146	West Germany 11,334; United Kingdom 10,696; France 6,671.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Lead —Continued				
Metal including alloys:				
Scrap	11,626	6,218	420	Netherlands 2,927; France 1,196; Ireland 1,050.
Unwrought	49,391	61,379	708	France 17,706; United Kingdom 16,848; Mexico 13,262.
Semimanufactures	3,573	4,408	11	United Kingdom 2,301; West Germany 934; France 580.
Lithium:				
Oxides and hydroxides	175	187	--	West Germany 95; Netherlands 69; United Kingdom 23.
Metal including alloys, all forms	2	1	--	All from France.
Magnesium: Metal including alloys:				
Scrap	438	162	13	Italy 43; West Germany 29; Switzerland 26.
Unwrought	2,946	2,730	146	Italy 753; Netherlands 729; France 489.
Semimanufactures	1,222	1,486	65	Italy 819; West Germany 360; France 87.
Manganese:				
Ore and concentrate, metallurgical-grade	230,710	199,138	4	Brazil 70,717; Congo 56,682; Australia 31,071.
Oxides	1,090	1,484	52	Japan 733; Netherlands 348; France 147.
Metal including alloys, all forms	2,096	2,994	1,361	Republic of South Africa 749; France 633.
Mercury 76-pound flasks	7,534	6,148	NA	Spain 2,610; United Kingdom 2,262; Netherlands 1,044.
Molybdenum:				
Ore and concentrate	22,150	22,406	2,384	Canada 7,667; China 3,262; Netherlands 2,823.
Oxides and hydroxides	39	147	--	Netherlands 73; West Germany 53; United Kingdom 20.
Metal including alloys:				
Scrap	24	35	(2)	West Germany 16; Austria 8; France 8.
Unwrought	11	19	(2)	West Germany 7; France 3; United Kingdom 3.
Semimanufactures	188	157	2	Netherlands 112; United Kingdom 31; Austria 5.
Nickel:				
Ore and concentrate	--	1,087	--	Netherlands 1,061; United Kingdom 26.
Matte and speiss	1,669	1,943	4	Netherlands 959; West Germany 812; United Kingdom 14.
Oxides and hydroxides	142	746	(2)	Australia 493; Netherlands 127; Canada 113.
Ash and residue containing nickel	2,838	2,395	23	West Germany 959; Netherlands 297; United Kingdom 257.
Metal including alloys:				
Scrap	527	304	19	West Germany 116; Netherlands 45; France 34.
Unwrought	2,596	3,787	51	Netherlands 2,197; West Germany 867; Canada 259.
Semimanufactures	1,923	804	62	West Germany 415; Netherlands 133; United Kingdom 115.
Platinum-group metals:				
Waste and sweepings value, thousands	$9,886	$13,574	--	Netherlands $6,524; Algeria $4,378; France $1,346.
Metals including alloys, unwrought and partly wrought do	$16,089	$22,224	$2,803	United Kingdom $11,565; France $2,064.
Rare-earth metals including alloys, all forms	65	54	(2)	Austria 36; France 14; Brazil 3.
Rhenium: Metal including alloys, all forms	(2)	1	(2)	Mainly from United Kingdom.
Selenium, elemental	168	309	(2)	Netherlands 243; United Kingdom 39; West Germany 21.
Silicon, high-purity	(2)	1	(2)	Mainly from West Germany.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Silver:				
Ore and concentrate[3]				
value, thousands	$29,329	$21,270	$8,843	Peru $10,607; Bolivia $915.
Waste and sweepings do	$1,275	$1,839	$302	West Germany $853; United Kingdom $290.
Metal including alloys, unwrought and partly wrought				
thousand troy ounces	47,226	43,918	25,078	Netherlands 16,815; United Kingdom 1,061.
Tellurium and arsenic, elemental	83	79	--	Sweden 53; West Germany 18; Netherlands 5.
Tin:				
Ore and concentrate	556	102	--	Peru 40; Nigeria 33; Bolivia 18.
Oxides	11	9	--	France 4; Netherlands 4; United Kingdom 1.
Ash and residue containing tin	517	728	39	Netherlands 421; West Germany 168; East Germany 42.
Metal including alloys:				
Scrap	404	337	56	France 132; Ireland 59.
Unwrought	3,853	3,536	25	Denmark 1,359; Netherlands 1,003; United Kingdom 292.
Semimanufactures	288	402	1	Netherlands 232; West Germany 97; France 46.
Titanium:				
Ore and concentrate	122,299	106,814	--	Canada 96,397; Norway 9,746; Netherlands 533.
Oxides	7,208	5,904	43	West Germany 3,909; France 981; United Kingdom 609.
Metal including alloys:				
Scrap	1,101	713	435	Canada 177; West Germany 42.
Unwrought	65	16	5	West Germany 6; United Kingdom 5.
Semimanufactures	147	130	5	Italy 29; West Germany 28; United Kingdom 22.
Tungsten:				
Ore and concentrate	278	54	--	Hong Kong 52; Netherlands 2.
Oxides and hydroxides	5	20	(2)	China 19.
Ash and residue containing tungsten	2	5	--	All from West Germany.
Metal including alloys:				
Scrap	102	95	3	Hong Kong 45; United Kingdom 30; West Germany 7.
Unwrought	48	27	(2)	Austria 9; Netherlands 8; France 4.
Semimanufactures	113	142	4	Netherlands 127; United Kingdom 4.
Uranium and/or thorium:				
Ore and concentrate				
value, thousands	$4	$1,505	$1,500	Denmark $4; West Germany $1.
Oxides and other compounds do	$647	NA		
Metal including alloys, all forms:				
Uranium do	$18	$2	$2	
Thorium do	$1	$20	--	West Germany $15; France $4; Netherlands $1.
Vanadium:				
Ore and concentrate	1	44	17	Australia 27.
Oxides and hydroxides	4,049	4,056	54	China 2,179; Republic of South Africa 1,373; West Germany 223.
Ash and residue containing vanadium	18,091	9,123	--	Republic of South Africa 6,091; West Germany 2,445; Netherlands 587.
Metal including alloys:				
Scrap	(2)	1	--	All from West Germany.
Unwrought	350	131	131	
Semimanufactures	(2)	(2)	--	Mainly from West Germany.
Zinc:				
Ore and concentrate	568,469	520,277	4,719	Canada 130,192; France 78,927; Peru 53,564.
Oxides	10,553	9,783	154	Netherlands 3,926; France 3,024; West Germany 1,115.
Blue powder	691	1,033	11	France 404; Netherlands 379; West Germany 180.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Zinc —Continued				
Matte	771	788	--	West Germany 326; Switzerland 215; France 97.
Ash and residue containing zinc	61,132	73,963	15,093	West Germany 27,255; France 11,337.
Metal including alloys:				
Scrap	10,081	7,310	159	Netherlands 3,638; West Germany 1,708; France 1,018.
Unwrought	51,547	49,091	91	Netherlands 22,450; West Germany 11,255; France 6,640.
Semimanufactures	18,826	18,762	15	France 15,535; West Germany 2,055; Netherlands 1,030.
Zirconium:				
Ore and concentrate	5,954	3,112	--	Netherlands 1,920; West Germany 598; Australia 489.
Metal including alloys:				
Scrap	43	52	--	France 35; United Kingdom 12; Netherlands 3.
Unwrought	3	3	3	
Semimanufactures	128	188	10	France 163; United Kingdom 9.
Other:				
Ores and concentrates	116,555	181,038	--	Norway 167,319; Australia 13,717; West Germany 27.
Oxides and hydroxides	849	102	1	West Germany 30; United Kingdom 27; France 21.
Ashes and residues	15,468	17,686	8,993	France 5,052; Netherlands 1,212.
Base metals including alloys, all forms	7	2	--	All from United Kingdom.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	7,604	8,579	112	West Germany 6,729; Italy 690; Greece 340.
Artificial:				
Corundum	8,200	8,011	16	Brazil 2,525; West Germany 2,163; France 1,364.
Silicon carbide	5,532	4,710	4	West Germany 2,713; Italy 1,189; Spain 234.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$20,413	$22,442	$7,849	Ireland $11,580; United Kingdom $581.
Grinding and polishing wheels and stones	3,759	3,686	89	West Germany 1,077; Italy 599; Netherlands 493.
Asbestos, crude	25,138	25,017	18	Canada 13,561; Republic of South Africa 3,509; U.S.S.R. 2,337.
Barite and witherite	8,193	8,439	--	West Germany 7,145; France 815; Thailand 165.
Boron materials:				
Crude natural borates	40,284	50,402	955	Turkey 48,657; Netherlands 442.
Elemental	(2)	1	--	All from Sweden.
Oxides and acids	2,649	2,992	21	France 1,748; Italy 590; Netherlands 220.
Bromine	1,281	1,689	28	Israel 1,344; United Kingdom 183; Netherlands 69.
Cement	351,908	343,889	22	Netherlands 211,385; West Germany 111,992; France 9,344.
Chalk	165,853	162,764	18	France 141,676; Netherlands 20,869; West Germany 139.
Clays, crude:				
Bentonite	20,166	20,007	5	West Germany 9,224; Netherlands 7,650; United Kingdom 3,036.
Chamotte earth	58,917	73,552	1,148	West Germany 56,205; France 12,434; Spain 3,001.
Fuller's earth	1,520	1,173	18	United Kingdom 690; Netherlands 206; Spain 152.
Kaolin	297,481	311,423	3,617	United Kingdom 121,291; Netherlands 117,757; France 32,708.
Unspecified	215,362	203,691	2	West Germany 166,846; Netherlands 17,086; France 10,437.
Cryolite and chiolite	48	32	--	All from Denmark.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Diamond:				
Gem, not set or strung value, thousands	$2,818,843	$3,819,058	$262,896	United Kingdom $1,684,698; U.S.S.R. $348,889; Israel $295,844.
Industrial stones do.	$75,424	$69,980	$18,172	Australia $8,083; Zaire $7,674.
Diatomite and other infusorial earth	8,463	8,304	1,020	France 3,178; Spain 2,530; Denmark 1,028.
Feldspar, fluorspar, related materials:				
Feldspar	17,806	18,372	5	France 14,146; West Germany 3,298; Italy 845.
Fluorspar	7,773	7,662	--	France 4,912; East Germany 1,066; West Germany 734.
Unspecified	29,482	30,005	--	Norway 25,875; Netherlands 3,198; West Germany 592.
Fertilizer materials:				
Crude, n.e.s	111,219	108,014	--	Netherlands 100,662; France 3,785; West Germany 3,258.
Manufactured:				
Ammonia	3,567	3,961	--	Netherlands 3,041; West Germany 556; France 346.
Nitrogenous thousand tons	607	924	79	U.S.S.R. 197; West Germany 192; Netherlands 185.
Phosphatic do.	207	120	1	Kuwait 48; Morocco 20; Iraq 13.
Potassic do.	1,137	1,255	132	West Germany 516; U.S.S.R. 199.
Unspecified and mixed do.	497	447	98	West Germany 187; Netherlands 50.
Graphite, natural	827	951	(2)	West Germany 610; Paraguay 250; Brazil 35.
Gypsum and plaster	401,794	507,961	231	France 363,576; West Germany 91,929; Netherlands 51,530.
Iodine	180	104	1	Japan 48; Netherlands 36; France 14.
Kyanite and related materials	2,494	1,350	267	Republic of South Africa 369; West Germany 350.
Lime	117,065	145,739	2	West Germany 72,171; France 71,342; Netherlands 2,140.
Magnesium compounds:				
Magnesite, crude	318	803	--	Netherlands 725; France 48; West Germany 30.
Oxides and hydroxides	19,617	21,446	341	United Kingdom 4,856; Austria 3,266; Czechoslovakia 3,000.
Other	21,227	24,650	--	West Germany 16,774; East Germany 7,677; Netherlands 199.
Mica:				
Crude including splittings and waste	4,561	7,348	7	India 5,529; Madagascar 850; France 401.
Worked including agglomerated splittings	17	37	(2)	Switzerland 17; France 11; West Germany 3.
Nitrates, crude	39,327	33,662	--	Chile 33,483; Netherlands 159; West Germany 20.
Phosphates, crude thousand tons	2,482	2,287	333	Morocco 1,450; Republic of South Africa 255.
Phosphorus, elemental	244	297	(2)	Republic of South Africa 119; France 106; China 30.
Pigments, mineral:				
Natural, crude	290	202	5	Cyprus 76; Republic of South Africa 40; West Germany 35.
Iron oxides and hydroxides, processed	8,031	8,662	815	West Germany 5,990; Netherlands 620.
Potassium salts, crude	40,155	39,460	--	West Germany 20,688; France 10,183; East Germany 8,581.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$11,587	$14,767	$3,370	Thailand $2,975; Switzerland $2,168.
Synthetic do.	$4,974	$6,233	$1,656	Ireland $4,018; United Kingdom $183.
Pyrite, unroasted	276,967	260,194	--	Spain 168,491; Norway 58,988; Finland 23,153.
Salt and brine thousand tons	1,344	1,341	(2)	Netherlands 804; West Germany 433; France 28.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sodium compounds, n.e.s.: Carbonate, manufactured	106,342	87,584	2	France 31,644; West Germany 28,677; Netherlands 27,188.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked thousand tons	161	128	(2)	France 47; West Germany 33; Italy 7.
Worked do	109	121	--	France 33; Netherlands 29; Italy 25.
Dolomite, chiefly refractory-grade do	52	46	--	West Germany 24; France 11; Netherlands 10.
Gravel and crushed rock do	4,667	4,871	1	Netherlands 2,617; West Germany 852; United Kingdom 808.
Limestone other than dimension do	236	212	--	United Kingdom 150; France 57; West Germany 4.
Quartz and quartzite do	81	74	(2)	West Germany 56; France 9; Norway 7.
Sand other than metal-bearing do	9,756	10,243	1	Netherlands 8,665; West Germany 1,172; France 321.
Sulfur:				
Elemental:				
Crude including native and byproduct	492,263	397,665	199,891	West Germany 51,108; Netherlands 42,313.
Colloidal, precipitated, sublimed	1,352	1,451	2	France 617; West Germany 535; Netherlands 228.
Dioxide	5,366	4,224	--	West Germany 2,988; France 1,049; Netherlands 110.
Sulfuric acid	654,344	753,947	(2)	West Germany 238,900; Netherlands 139,323; France 131,816.
Talc, steatite, soapstone, pyrophyllite	58,735	68,616	6,091	Spain 20,329; Netherlands 12,520; Australia 10,668.
Vermiculite, perlite, chlorite	78,340	57,843	--	Turkey 29,113; U.S.S.R. 17,216; West Germany 4,161.
Other:				
Crude thousand tons	1,231	1,665	4	France 978; Netherlands 236; West Germany 228.
Slag and dross, not metal-bearing do	554	633	--	Netherlands 359; France 181; West Germany 93.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	77,545	100,974	90	France 97,643; West Germany 1,780; Netherlands 1,320.
Carbon:				
Carbon black	r19,562	25,562	497	Netherlands 23,204; West Germany 1,233.
Gas carbon	24,426	23,419	77	France 13,562; West Germany 8,890; United Kingdom 642.
Coal:				
Anthracite thousand tons	1,419	1,663	--	West Germany 80; France 9; Netherlands 3.
Bituminous do	7,962	7,092	3,710	Republic of South Africa 1,820; West Germany 694.
Briquets of anthracite and bituminous coal do	135	93	--	West Germany 894; Republic of South Africa 195; China 177.
Lignite including briquets do	425	366	--	West Germany 325; East Germany 39; Netherlands 1.
Coke and semicoke do	2,510	2,349	66	West Germany 1,560; Netherlands 416; United Kingdom 89.
Gas, natural, gaseous million cubic feet	330,241	362,400	--	Netherlands 188,734; France 100,886; West Germany 72,780.
Peat including briquets and litter	140,327	168,245	--	Netherlands 106,449; West Germany 41,115; U.S.S.R. 19,502.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude_ thousand 42-gallon barrels_ _	113,067	147,329	_ _	Saudi Arabia 40,455; United Kingdom 28,895; Nigeria 18,950.
Refinery products:				
Liquefied petroleum gas do_ _ _	7,441	6,548	(2)	Netherlands 3,092; Norway 1,476; United Kingdom 757.
Gasoline _ _ _ _ _ _ _ _ _ _do_ _ _	22,390	21,723	12	Netherlands 11,171; Spain 1,865; United Kingdom 1,694.
Mineral jelly and wax _ _do_ _ _	134	137	1	West Germany 81; Netherlands 27; France 22.
Kerosene and jet fuel_ _ _do_ _ _	1,993	2,263	4	Netherlands 2,057; Algeria 63; Romania 45.
Distillate fuel oil _ _ _ _ _do_ _ _	33,958	36,252	219	Netherlands 25,560; United Kingdom 1,386; West Germany 1,257.
Lubricants _ _ _ _ _ _ _ _ _do_ _ _	4,054	3,878	115	France 1,347; Netherlands 991; United Kingdom 561.
Residual fuel oil_ _ _ _ _ _do_ _ _	50,719	61,667	_ _	Netherlands 22,253; U.S.S.R. 17,666; Italy 3,712.
Bitumen and other residues do_ _ _	803	1,270	(2)	Netherlands 426; France 301; Spain 202.
Bituminous mixtures_ _ _do_ _ _	72	118	2	Netherlands 60; France 36; West Germany 13.
Petroleum coke _ _ _ _ _ _do_ _ _	1,923	2,274	2,145	United Kingdom 48; West Germany 45.

[r]Revised. NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

COMMODITY REVIEW

Metals.—*Iron and Steel.*—A major development for Belgium's iron and steel industry in 1987 was the European Economic Community (EEC) Commission decision to compensate EEC producers for lost export sales to developing countries. The decision, taken in Brussels, permits European producers to convert part of their production quotas into EEC delivery quotas as a means of coping with the significant drop in community exports worldwide. The export decline was caused by the weak U.S. dollar.

The mechanics of the conversion favor those companies whose ratio of deliveries to the EEC is below average. Moreover, the process was designed so that those companies with above average delivery ratios will not benefit from the system.

A major result of the EEC Commission decision was a submission of complaint to the European Court of Justice by the European Independent Steelworks Association (EISA). EISA alleged the decision was illegal since it was not consulted in advance about the pending action, via procedures required by the European Coal and Steel Community Treaty. It was said that EISA was particularly unhappy that, as a supplier with an above average ratio of deliveries to the EEC, its membership would be at a disadvantage, vis-a-vis sales, under the new system. Reportedly supporting EISA's stance on the matter was Belgium's Cockerill-Sambre SA (CS), the integrated steel producer.

More broadly, CS has indicated strong support for the preservation of production quotas until 1990 as a means of facilitating the restructuring effort centered around CS' production activities. In 1987, output of steel amounted to the 1982 level of 4.31 million tons. Production was achieved, however, with 12,000 workers, one-half the number required 5 years earlier and a reduction of 2,000 below the 1986 level. In addition, the company planned to close its cold-rolled mill at Jemeppe, in southeastern Belgium, within the next 2 years and to modernize the nearby Liège cold-rolled mill to offset lost capacity resulting from the shutdown. It was expected that from this aspect of the CS restructuring program,

costs could be cut by $256.6 million. Moreover, net losses could be halved from $109 million to $54.5 million; however, the effects of a 2-week strike in January 1987 to protest the proposed layoffs may alter these projections.

Another dimension of the CS restructuring program entailed the reorganization of Disteel, the CS Belgian trading and distribution arm. Disteel consolidated 10 subsidiaries into 5 new businesses organized by product categories and geographic areas. In particular, three distribution centers, each exclusive to long products, hot-rolled flat products, and cold-rolled flat products were scheduled for development, as were two additional operations, geographic in nature, that would handle other products.

During the reorganization process, those plants deemed obsolete or inefficient, particularly in the face of declining sales, were scheduled for closure. Furthermore, 120 out of 1,000 employees were terminated.

As a means of reducing its vulnerability to competition, CS began diversification away from core steel production toward the value-added output of downstream activities. In 1987, CS undertook expansion of its Phoenix works galvanizing operation with a new 240,000-ton-per-year line worth an estimated $68.2 million. In a related development, CS' Mechanical Industries was awarded a contract for a Galvalume line to be set up in the U.S.S.R. at the Cherepovets works, 300 kilometers north of Moscow. The contract provides for equipment supply and technology transfer of $20.9 million.

Sidmar, Belgium's second largest steelmaker, increased its rolled steel production by 6.2%, from 2,500 tons in 1986 to 2,600 tons in 1987. The company's raw steel output fell, however, to 2,860 tons in 1987 from 3,110 tons the previous year, a drop of 8.1%. The decline in raw steel output was the direct result of a strike against the company in February 1987, when about 4,700 of the company's 6,000 workers walked out after failing to reach agreement with management over wages. The 4-week strike caused Sidmar to post a financial loss for 1987.

The Belgian pipemaker Tubermuese, owned by Laminoirs de Saint-Eloi, received an order worth $20.5 million from the U.S.S.R. for oil well pipe. The contract, however, was only a stopgap measure insufficient to preclude the company's bankruptcy, which occurred in February. The bankruptcy resulted from poor demand for tube and pipe and costly production operations.

In February 1987, the company was placed in receivership, and it was uncertain whether production would resume. Soconord, the Brussels pipe-trading company, bid $10.4 million to take ownership of the tube and pipe manufacturer, including its melting shop, mill, and finishing businesses. Soconord also proposed average capital outlays of $15 million to upgrade electric-furnace facilities in the Tubermeuse steel shop. Moreover, the suitor indicated a willingness to carry a social charge of $12.3 million to be allocated to Tubermeuse's 750 employees in the event of a shutdown.

In addition to this bid and a bid from the Chinese Government, the management of Laminoirs de Saint-Eloi had another option. It set forth a plan to restart production at Tubermeuse in June 1987 at an output of 53,000 tons per year of bar, the minimum necessary to produce an operating margin sufficient to secure the capital required for modernization. The bank, which held the rights of sale to the Tubermeuse works, however, was not prepared to accept the Laminoirs plan despite the fact that financing for the resumption of operations was successfully arranged.

ALZ, the Belgian stainless producer, purchased a 2-meter-wide, cold-rolled mill to replace its existing 1.35-meter mill at a cost of $130.9 million. Plant-builder Schloemann-Siemag AG of the Federal Republic of Germany supplied the company's new reversing cold-rolled mill for reduction and temper rolling. The plant was scheduled to start up in June 1989.

The new facility was purchased to replace ALZ's existing 20-year-old mill, with a view toward improving product quality. Capacity was expected to rise from 80,000 tons per year in 1987 to 104,000 tons per year when the mill's operations commence. It was not expected, however, that output of CR strip would increase substantially.

Lead and Zinc.—During late January and early February 1987, Vieille-Montagne SA (VM), the Belgian zinc producer, encountered malfunctions of its Balen furnace. That problem, coupled with severely cold weather, cost the company about 5,000 tons of lost zinc production. Both problems were resolved, however, and it was expected that output from Balen would amount to 170,000 tons for the year.

During the same period, VM brought its new 100,000-ton-per-year electrolytic zinc line at Auby in northern France to capacity levels. With the new facilities, total annual

capacity at Auby was more than doubled to 210,000 tons.

The new equipment was expected to produce considerable cost savings. Only 60 additional workers were hired at Auby to double production capacity. This compared with the 500 employees required to work the much older 100,000-ton-per-year facility at Viviez, in the south of France.

The transfer of production from Viviez to Auby was a major element in the restructuring plan pursued by VM as a means of cutting losses. In addition, the company installed an 850-ton-per-day, zinc ore roasting plant at Balen allowing greater intake flexibility and cost efficiency.

Manganese.—Belgische Vennootschap voor Mangaanproduktie (BVM), Belgium's manganese alloy producer, restarted production from one of its three furnaces at the end of April 1987. Closure of the facilities in 1986 was the result of weakened demand for manganese alloys. Average annual output of 55,000 tons was reduced by 33%.

In 1987, production was expected to amount to 40% to 70% of capacity. Total capacity of the three furnaces is 160,000 tons per year. Reportedly, operations resumed in response to a depletion of stocks rather than to any improvement in the manganese alloys market.

Titanium.—NL Chemicals SA, owned by NL Industries Inc., was to have invested $57.3 million in a titanium pigment plant at Langerbrugge, near Ghent. The new plant, expected to come on-line by the end of 1989, will use the chlorine process as opposed to the sulfate process utilized by the facility it was intended to replace. The chlorine process was expected to reduce the SO_2 emissions of the plant by 90%.

Industrial Minerals.—Société Chimique Prayon-Rupel SA (Prayon) invested $5.3 million in a new gypsum disposal system at its Ruisbroek, Puurs, facility, about 1,200 kilometers south of Antwerp. The system carries gypsum slurry neutralized with chalk at Ruisbroek via a pumping unit and a high-density pipeline across the Rupel River and discharges into a large excavated clay pit at Rumst, 600 kilometers southeast of the plant. Because the pit rim is pitched, one level of diking was installed south of Rumst at a cost of $500,000. Also, it was determined that two additional levels of diking would be required to enable these pits to be used for at least 7 years.

Environmental considerations were the major determinants of the slurry discharge method selected. The method itself entails effluent emission at a depth sufficiently below the top layer of water so that neither planar disturbance nor gypsum is visible on the surface. Any excess water drains into the Rupel, where an automatic monitor tracks acid-alkaline levels for adherence to international standards for pH content.

To control the Rupel's slightly alkaline pH balance, Prayon, in August 1987, opted to carefully measure and control emissions rather than to apply an offsetting acidic compound that could have endangered the ecology of the Rupel.

Mineral Fuels.—*Coal.*—In 1987, the Belgian Government accepted the recommendation of the Gheyselnick report. This report evaluated the operating losses of the coal mining sector of the economy and determined the funds needed to sustain the industry during 1987-96. In broad terms, the plan called for the reduction of operating losses to $98 million per year by 1996, as opposed to annual operating losses in 1987 of $392 million. In addition, Government subsidization of the coal industry would be reduced from $220 million to $103.5 million over the next 10 years. Moreover, total employment in the coal mining sector was to be reduced from 17,200 in 1987 to 9,000 in 1991. Finally, the amount of coal produced by Kempense Steenkolenmijnen (KS) would be reduced to 3.2 million tons in 1996, one-half the 1986 output.

Specific implementation of the Gheyselnick recommendations in 1987 entailed the closure of the Waterschei and Eiden Mines in September and December 1987, respectively, and the planned shutdown of the Winterschlag Mine by July 1988. All three facilities compose the eastern half of the Kempen Coalfield in the Province of Limburg. The decision to curtail production was based on the assessment that continued output of 6 million tons per year at the Kempen Coalfield would result in losses of $400 million per year.

An immediate effect of the closures was a month-long strike by 18,500 miners, who protested the planned cut of 8,200 jobs. The walkout quickly spread from the three mines affected to all pits within Belgium, bringing mine output to a standstill during the month of March.

Natural Gas.—In June 1987, the liquefied natural gas terminal at Zeebrugge commenced operations, receiving Algerian gas. Distrigaz, the gas importer and distributor owned 50% by the Belgian Government, extended its existing agreement with Algeria to purchase 3 billion cubic meters of

natural gas at a price of $3.19 per million British thermal unit (Btu). The contract between the two parties expires in the year 2002.

Meanwhile, an undersea pipeline scheduled to be built by Norway in 1993, will run 1,000 kilometers between the North Sea and Zeebrugge. The pipeline is slated to carry to Belgium 2 billion cubic meters of natural gas from the Troll and Sleipner Fields in the northern sector of the North Sea.

Nuclear Power.—Belgium's seven nuclear reactors operated at or near full capacity. The units, pressurized water reactors with double containment structures, accounted for 68% of electricity production in 1987, compared with 66.7% in 1986. This share is among the highest for member countries of the International Energy Agency.

Petroleum.—In June 1987, Petrofina S.A., the Belgian energy concern, and Neste Oy, the Finnish oil and chemicals corporation, reportedly invested $354.6 million and $190.9 million, respectively, in a new company, Finaneste. The new enterprise planned to construct a steamcracker with an annual capacity of 450,000 tons of ethylene on the left bank of the Schelde River in Antwerp. In addition, Finaneste took over Petrofina's two existing steamcrackers and auxiliary plants at Antwerp.

It was expected that these investments would increase Finaneste's annual ethylene production capacity from 550,000 tons to one million tons. The gain in output, coupled with Finaneste's proximity to refineries and Europe's main pipelines, was expected to provide a highly efficient supply and distribution system.

In a second deal, Petrofina and British Petroleum Co. (BP) agreed in principle that Petrofina would buy from BP its 50% share in the Sibp S.A. refinery in Antwerp, the largest in Belgium. With this acquisition Petrofina would center its continental European refining and petrochemical activities in Antwerp.

LUXEMBOURG

In 1987, Luxembourg's economy enjoyed GNP growth of 2.5%, low unemployment of about 1.5%, and negligible inflation. Within this milieu, minerals and metals accounted for a significant portion of Luxembourg's foreign trade. Measured in terms of value, metals composed about 15% of imports; oil products approximately 9%; coal and coke nearly 4%; and unrefined minerals, about 4% of total imports. Metals also amounted to 4% of exports. EEC and European Free Trade Association countries provided more than 90% of imports and took about 80% of exports.

Despite corporate tax cuts of approximately 2% of the GNP and concomitant increases of 4% in capital formation and 2.5% in industrial production, raw steel production fell 10.9% from that of 1986, causing Luxembourg's ranking to fall from 30th to 32d among the world's steel producing nations in 1987. Correspondingly, steel production as a percent of the GNP fell from just over 11% in 1986 to 9.9% in 1987.

Several factors were responsible for the decline in steel output. They included a worldwide drop in steel demand, a reduction in exports resulting from the falling U.S. dollar, imports from developing countries at dumping prices, the risks attendant to the market liberalization set forth by the EEC Commission, and the inability of companies and EEC nations to coordinate capacity reductions.

In the first half of 1987, Arbed S.A., Luxembourg's only steel producer, incurred a first-half loss of $46.3 million, compared with a net profit of $21.9 million during the same period the year before. The drop resulted from a 10% reduction in rolled-product deliveries and an erosion of 15% in prices. Consequently, the company operated at 70% to 75% of its capacity.

In response to the adverse market conditions, Arbed undertook a program designed to pare down production costs $55 to $82 million under 1986 levels. Specifically, the company reduced its labor force by more than 700 people and shut down a blast furnace at its Esch Beval works in southern Luxembourg. Moreover, in an attempt to sustain sales revenues, the company sought to raise prices on those steel products tied to the falling value of the U.S. dollar, thereby offsetting losses on its dollar-denominated exports. Simultaneously, Arbed's coated-sheet subsidiary Galvalange began marketing a new coated product, Alugal. Composed of cold-rolled sheet coated with an aluminum alloy of low silicon content, Alugal is especially useful in high-temperature applications in the automotive industry, furnace construction, and domestic electrical appliances.

The aforementioned drop in steel output resulted in a 9% decline in coal consumption. Luxembourg's coal demand is strongly linked to its steel industry, which takes

more than 80% of the coal imported.

Luxembourg has neither indigenous coal and petroleum resources nor any oil refineries. In 1987, nearly 90% of oil products was imported from Belgium, with the remainder supplied by other European nations. In addition, 85% of Luxembourg's natural gas was imported from Belgium by Société de Transporte de Gaz (Soteg), jointly owned by the state and the private sector. France provided the other 15%. Reliance on these two natural gas suppliers was supposed to be reduced, however, because the Government was negotiating several new contracts with other parties.

[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Belgian francs (BF) to U.S. dollars at the rate of BF36.66=US$1.00.

Table 4.—Luxembourg: Production of mineral commodities[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
Cement, hydraulic	353	340	295	[e]300	[3]310
Gypsum and anhydrite, crude[e] tons	400	[3]450	400	420	[3]420
Iron and steel: Metal:					
Pig iron (including blast furnace ferroalloys)	2,316	2,768	[r e]2,880	2,652	[3]2,305
Steel:					
Crude	3,294	3,987	3,945	3,705	[3]3,301
Semimanufactures	2,828	3,550	3,878	3,770	3,800
Phosphates: Thomas slag, gross weight	586	728	701	[e]650	700
Sand and gravel:					
Foundry sand tons	--	2,000	1,500	[e]2,000	2,000
Other sand except glass sand thousand cubic meters	703	140	570	[e]500	500
Gravel do	129	135	80	61	70
Stone:					
Construction:					
Crushed do	785	96	461	[e]450	450
Dimension:					
Rough cut do	12	8	--	5	6
Facing square meters	598	560	245	[e]250	300
Finished cubic meters	623	729	800	[e]750	750
Flagstone:					
Polished square meters	1,775	1,260	1,694	[e]1,500	1,600
Rough tons	299	209	1,830	[e]1,000	850
Slate slabs thousand pieces	834	646	683	[e]700	750
Industrial:					
Dolomite	330	350	--	[e]100	200
Quartzite	20	25	7	[e]10	15

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

[1]Table includes data available through June 24, 1988.

[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.

The Mineral Industry of Bolivia

By Pablo Velasco[1]

The mining sector historically has been the backbone of Bolivia's economic development and remains a major source of foreign exchange, tax revenues, and employment. Tin has been the country's most important mineral, providing more than 90% of the total nonfuel mineral export sales, with antimony, gold, lead, silver, tungsten, and zinc being the other important nonfuel minerals.

The year 1987 was a difficult one in the long history of Bolivia's mining industry. The real value of mine production was at its lowest level in 9 years, and employment fell drastically.

In a historic change, the state mining corporation, Corporación Minera de Bolivia (COMIBOL) was decentralized by Supreme Decree No. 21377. Today COMIBOL operates as a holding company with five autonomous subsidiary mining companies and two autonomous smelter enterprises. This reorganization replaced the former inefficient centralized administrative system that had directed and controlled more than 21 mining companies and 11 service subsidiaries.

Tin has become a commodity of reduced significance in the national economy, which it had dominated since 1900. However, at yearend there was an indication that the tin crisis, caused by a sharp drop in prices, was over, and the mineral industry was stabilized with prospects of a modest recovery in 1988 and years ahead.

The Bolivian economy expanded slightly in 1987 after 5 consecutive years of decline. Preliminary estimates indicate that the growth was slightly more than 2.0% relative to that of 1986. Rigorous economic measures imposed in mid-1985 succeeded in curbing hyperinflation and stabilizing the currency. However, low world market prices for Bolivia's hydrocarbons and mineral exports, as well as the restructuring of several state-owned enterprises, led to large-scale reduction of personnel in both the public and private sectors. Unemployment averaged 20% during 1987.

The Government's economic reactivation program, announced in July 1987, aimed to reform the banking system, promote exports, and create a climate more favorable to foreign investors. Nevertheless, as of late 1987 many of its proposals had yet to be implemented. Internal structural problems such as high transportation and credit costs continued to inhibit recovery and economic expansion.

Bolivia remained dependent on natural gas exports to Argentina for a large portion of its total export earnings. Hydrocarbons and nonfuel mineral exports accounted for 81% of the total export value. In 1987, the hydrocarbons sector contributed 44% of total exports; nonfuel minerals, 37%; and agriculture and others, 19%.

Government Policies and Programs.—The policy of the present Government is to create an environment in which individuals and private companies are free to search for new ore deposits, to invest in them, and to benefit from the effort and capital expended. New tax laws that support this policy are equitable for the investor, labor, and the country.

The restructured COMIBOL, as a holding company, is headed by a general board of directors that includes a president, two board members appointed by the President of Bolivia, and one board member appointed by the Miner's Union Federation (FSTMB). The general board of directors appoints COMIBOL's general manager and those of the subsidiary companies. The board of

directors approves COMIBOL's budget, delineates company policies, and approves and supervises the leasing contracts of the company's mining properties.

The five subsidiary mining companies under direct supervision of COMIBOL are Cía. Minera de Oruro (Oruro Mining Co.) responsible for the San José tin-silver mine, Huanuni tin mine, Bolivar tin-zinc silver mine, María Luísa tin mine, and Poopó tin mine; Cía. Minera de La Paz (La Paz Mining Co.) responsible for the Caracoles tin mine; Cía. Minera de Potosí (Potosi Mining Co.) responsible for the Unificada-del Cerro Rico de Potosí tin-silver mine and the La Palca tin fuming plant; Cía. Minera Quechisla (the Quechisla Mining Co.) responsible for the San Vicente zinc-silver mine, Chocaya tin mine, Tasna bismuth-gold mine, Tatasi lead-zinc-silver mine (it also will be in charge of the hydroelectric plant of Rio Yura and the Pulacayo mining equipment factory); and Cía. Minera del Oriente (the Eastern Mining Co.) responsible for the Mutún iron-manganese mine.

The two subsidiary smelting companies created with their own boards of directors and management were (1) the Complejo Metalúrgico de Vinto (the Vinto metallurgical complex), formerly Empresa Nacional de Fundiciones, in charge of one antimony and two tin smelters at Vinto near Oruro City; and the Complejo Metalúrgico de Karachipampa (the Karachipampa metallurgical complex), which will be in charge of the Karachipampa lead-silver-zinc smelter in the Potosí Department.

COMIBOL was authorized by the Government to lease some of its mining properties to cooperatives composed chiefly of former workers of the company. The cooperatives will pay COMIBOL a rent of at least 1% of the net value of the minerals produced, and the lease contract will be for a minimum of 5 years and up to a maximum of 10 years. COMIBOL was authorized to rent the Catavi tin mine, the Colquiri tin mine, the Colquechaca tin-silver mine, the Japo tin mine, the Santa Fé tin mine, the Morococala tin mine, the Viloco tin mine, and the Machacamarca beneficiation plant.

PRODUCTION

In 1987, the Bolivian mining industry experienced a profound structural change. The regulations implemented by the Government after the collapse of the tin market in October 1985 were directed toward the reestablishment of the mining industry to a higher level of competency within the context of a free economy without subsidies, but with some financial and foreign exchange constraints. After 5 years of economic recession in the country, a new expansion cycle appeared to have begun. The volume of mining output increased by 25% in 1987 compared with that of 1986. The reactivation program produced more diversification in the mining sector with increased output of precious metals. The medium-size mining sector was the major factor in this improvement. In contrast, COMIBOL's production fell by about 59% compared with that of 1986, owing to the closure of several unprofitable tin mines during the first half of the year in accordance with the Government's rehabilitation guidelines.

Tin production by sectors during 1987 showed COMIBOL with a sharp decline of 91% to 384 tons compared with that of 1986, the lowest output ever registered by this state-owned corporation. This compares with COMIBOL's record high tin output of 33,740 tons in 1977. In 1987, COMIBOL's output of tin represented only 5% of the total. The medium-size mines accounted for 28%, and the small-size mining sector and cooperatives accounted for 67% of the total.

Other important mineral commodities produced in 1987 included silver, which emerged as the country's second most important mineral with an increase of 47%, followed by lead, 190%; zinc, 17%; and gold 261%. The expansion in gold production was due to a decrease in illegal sales to neighboring countries, to better prices offered by the Banco Minero de Bolivia (BAMIN) and private buyers, and to a favorable exchange rate. The level of gold obtained by the BAMIN agency was approximately 2.7 tons, which almost equals the production capacity of the country.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[p]
METALS[3]					
Antimony:					
Mine output, Sb content	9,951	9,281	8,925	10,243	10,635
Metal	[r]4,192	[r]861	762	1,171	1,723
Arsenic, mine output, arsenic trioxide, arsenic sulfide	107	144	361	241	132
Beryllium: Beryl concentrate:					
Gross weight	--	--	--	--	42
Be O content	--	--	--	--	3
Bismuth, mine output, Bi content	6	3	159	45	1
Cadmium, mine output, Cd content[4]	143	124	104	36	15
Copper, mine output, Cu content	1,982	1,610	1,665	338	9
Gold, mine output, Au content[5] troy ounces	49,217	40,827	[e]30,000	24,531	88,585
Iron ore:[6]					
Gross weight[e]	10,939	256	--	17	11
Fe content	7,001	4	--	11	7
Lead:					
Mine output, Pb content	11,838	7,448	6,242	3,121	9,043
Metal including alloys	301	185	231	182	201
Manganese ore:[6]					
Gross weight[e]	61	--	--	(7)	--
Mn content	28	--	--	(7)	--
Silver, mine output, Ag content thousand troy ounces	6,025	4,560	3,580	3,058	4,508
Tin:					
Mine output, Sn content	25,278	19,911	16,136	10,479	8,128
Metal, smelter	14,164	15,842	12,859	7,673	2,610
Tungsten, mine output, W content	2,449	1,893	1,643	1,095	638
Zinc, mine output, Zn content	47,132	37,770	37,110	33,472	39,122
INDUSTRIAL MINERALS					
Barite	516	984	1,282	129	1,337
Calcite	165	[e]150	23	300	600
Cement, hydraulic	327,300	285,600	379,500	295,200	396,017
Gypsum, crude[e]	750	700	700	[r]700	700
Salt[e]	10,000	10,000	10,000	10,000	10,000
Sulfur	3,010	1,878	2,741	4,730	8,746
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural:					
Gross million cubic feet	178,059	173,206	164,118	160,858	161,197
Marketable do	78,652	78,047	78,255	78,161	74,879
Natural gas liquids:					
Natural gasoline thousand 42-gallon barrels	728	601	593	540	514
Liquefied petroleum gas do	509	1,136	1,460	1,406	2,097
Petroleum:					
Crude do	8,100	7,621	7,245	6,956	6,890
Refinery products:					
Gasoline do	2,917	2,728	2,784	2,988	3,318
Jet fuel do	569	548	573	587	547
Kerosene do	647	653	578	358	360
Distillate fuel oil do	1,544	1,496	1,489	1,958	2,108
Residual fuel oil do	928	727	535	474	222
Lubricants do	115	74	67	107	107
Liquefied petroleum gas do	475	1,712	1,788	542	473
Unspecified do	550	20	12	66	73
Refinery losses[8] do	66	87	8	5	348
Total do	7,811	8,045	7,834	7,085	7,556

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

[1]Table includes data available through June 1988.

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

[3]Unless otherwise specified, data represent actual production by Corporación Minera de Bolivia (COMIBOL) and small- and medium-size mines.

[4]Cadmium contained in zinc concentrates produced by COMIBOL. (Cadmium is not recovered in elemental form in Bolivia.)

[5]Small- and medium-size mines output sales to Banco Minero de Bolivia (BAMIN) and COMIBOL exports (small- and medium-size mines cannot legally export gold).

[6]Data represent exports and are regarded as being equal to production.

[7]Reported as zero.

[8]Refinery fuel not reported separately, if at all, in recorded data.

TRADE

Total exports decreased by 15% compared with that of 1986, due primarily to decreased revenues from minerals and hydrocarbon sales. Foreign exchange reserves dropped substantially in 1987, due in part to Argentina's delayed payments for natural gas purchases. Hydrocarbon sales to Argentina, which accounted for more than one-half of Bolivia's total legal exports, dropped by 30% compared with that of 1986. Total exports were estimated at $562 million[2] compared with $665 million in 1986. Nonfuel mineral export revenues increased 5% compared with those of 1986 to $207 million or 37% of the total exports. Natural gas contributed 44% or $249 million of the country's total export value, exceeding the nonfuel mineral export revenue for the fifth consecutive year. Tin, traditionally Bolivia's main export, totaled 10,105 tons valued at $69 million, a decrease of nearly 40% in volume and 34% in value relative to that of 1986.

Compared with that of 1986, exports of other nonfuel minerals such as gold increased in volume 278% and increased in value 366%. Lead decreased in volume 42% and decreased in value 15%, silver decreased in volume 3.4% but increased in value 22.1%, tungsten decreased in volume 19% and decreased in value 23%, and zinc increased in volume 11% and increased in value 17%. The European Economic Community accounted for 53% of the total export value of mining and metallurgical products and the United States, 27%. The remaining 20% was distributed among the European Free Trade Association, the Council for Mutual Economic Assistance, Asia, the Andean Pact, the Latin American Integration Association, and others.

Officially registered imports in 1987 totaled $776 million, an increase of 9% compared with that of 1986. Total exports to the United States declined 11% compared with that of 1986 to $113 million, while imports from the United States increased 26% over those of 1986 to $139 million. New currency was issued at the end of 1986.

Table 2.—Bolivia: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1986	1987	Principal destinations, 1987
Antimony:			
Ore and concentrate	7,308	10,761	NA.
Trioxides	652	683	All to United Kingdom.
Metal including alloys:			
Regulus	50	652	Brazil 441; Spain 115; Colombia 48.
All forms	469	388	United Kingdom 253; Brazil 135.
Arsenic: Trioxides and other compounds	241	132	NA.
Barite and witherite	129	1,337	NA.
Beryllium: Ore and concentrate	--	42	NA.
Bismuth: Ore and concentrate	45	--	
Copper: Ore and concentrate	568	7	NA.
Gold:			
Ore and concentrate, troy ounces	7,969	39,429	NA.
Metal including alloys, unwrought and partly wrought	r11,638	44,040	NA.
Iron and steel: Iron ore and concentrate	11	7	NA.
Lead:			
Ore and concentrate	12,886	7,436	NA.
Metal including alloys	--	8	All to Panama.
Manganese: Ore and concentrate	28	--	
Silver: Ore and concentrate, thousand troy ounces	5,055	4,884	NA.
Sodium compounds, n.e.s.: Carbonate, natural	--	20	NA.
Sulfur, all forms	4,730	8,746	NA.
Tin:			
Ore and concentrate	8,618	8,255	NA.
Ash and residue containing tin, kilograms	330	--	
Metal including alloys, all forms	8,609	2,096	Colombia 409; Chile 202; United States 198.
Tungsten: Ore and concentrate	1,504	1,220	NA.
Zinc: Ore and concentrate	35,572	39,639	NA.

rRevised. NA Not available.

[1]Table prepared by H. D. Willis. Table includes partial provisional export data. Import data for 1985-87 were not available at the time of publication.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides value, thousands	$39	$24	$8	West Germany $12; Peru $2.
Metal including alloys:				
Unwrought	459	50	--	All from Brazil.
Semimanufactures	871	347	4	Brazil 209; Argentina 79; France 31.
Chromium: Oxides and hydroxides	--	1	--	All from West Germany.
Cobalt: Oxides and hydroxides value, thousands	$3	$1	--	All from Argentina.
Copper: Metal including alloys:				
Unwrought do	$3	$5	$2	Japan $3.
Semimanufactures	392	270	6	Peru 149; Brazil 55; West Germany 36.
Iron and steel: Metal:				
Scrap	11	--		
Pig iron, cast iron, related materials	401	112	--	Argentina 106; Brazil 6.
Ferroalloys:				
Ferromanganese	89	126	--	Brazil 93; Belgium-Luxembourg 33.
Unspecified	1,271	250	--	U.S.S.R. 205; Brazil 29; West Germany 16.
Steel, primary forms	338	81	--	Japan 77; Argentina 4.
Semimanufactures:				
Bars, rods, angles, shapes, sections	15,581	16,097	90	Argentina 6,247; Brazil 5,751; U.S.S.R. 1,178.
Universals, plates, sheets	17,332	8,626	463	Brazil 3,971; Japan 2,652; Chile 598.
Hoop and strip	280	163	(2)	Brazil 96; West Germany 67.
Rails and accessories	2,309	80	--	United Kingdom 41; Japan 21; France 14.
Wire	352	1,079	115	Argentina 477; Brazil 150; Chile 123.
Tubes, pipes, fittings	20,420	16,318	632	Argentina 7,412; Japan 4,310; Brazil 2,960.
Castings and forgings, rough	1,660	1,106	4	Peru 840; U.S.S.R. 168; United Kingdom 53.
Lead:				
Oxides	--	3	--	All from Peru.
Metal including alloys:				
Unwrought	1	10	5	Peru 5.
Semimanufactures value, thousands	$2	$2	--	All from West Germany.
Magnesium: Metal including alloys, semimanufactures	1	--		
Mercury value, thousands	$4	$1	$1	
Molybdenum: Metal including alloys, all forms do	$3	$1	--	All from Belgium-Luxembourg.
Nickel: Metal including alloys, semimanufactures do	$33	$1	--	All from Argentina.
Platinum-group metals: Metals including alloys, unwrought and partly wrought do	--	$1	--	All from West Germany.
Rare-earth metals including alloys, all forms	12	--		
Silver: Metal including alloys, unwrought and partly wrought value, thousands	--	$2	--	Do.
Tin: Metal including alloys, semimanufactures do	--	$1	--	All from Panama.
Titanium: Oxides	30	30	--	Finland 18; West Germany 7; Argentina 2.
Tungsten: Metal including alloys, all forms value, thousands	$34	$43	--	All from Netherlands.
Zinc:				
Ore and concentrate do	$1	--		
Oxides	22	16	--	West Germany 13; Netherlands 2; Peru 1.
Metal including alloys:				
Unwrought	710	117	--	Peru 96; Brazil 21.
Semimanufactures	1	4	4	
Other:				
Oxides and hydroxides	28	113	--	Brazil 103; West Germany 9; Canada 1.
Ashes and residues value, thousands	--	$2	$2	
Base metals including alloys, all forms	--	1	--	All from Brazil.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	--	1	1	
Grinding and polishing wheels and stones	39	41	1	Brazil 18; Peru 7; Norway 5.
Asbestos, crude	690	704	--	Brazil 448; Canada 253; France 2.
Boron materials:				
Crude natural borates	2	--		
Oxides and acids	2	1	--	All from West Germany.
Cement	7,871	5,087	244	Argentina 3,992; Chile 600; Brazil 251.
Chalk	2	10	1	Chile 9.
Clays, crude	704	247	86	Argentina 114; Brazil 45.
Diamond: Gem, not set or strung value, thousands	$4	--		
Diatomite and other infusorial earth	5	375	370	West Germany 5.
Fertilizer materials: Manufactured:				
Ammonia	34	21	--	Brazil 16; West Germany 5.
Nitrogenous	4,793	7,347	75	Netherlands 5,086; West Germany 1,283; Brazil 588.
Phosphatic	--	802	--	Netherlands 470; Argentina 301; Brazil 31.
Potassic	6	112	--	Netherlands 111; Brazil 1.
Unspecified and mixed	158	5,916	5,900	Brazil 11; West Germany 4.
Graphite, natural	13	3	--	All from Brazil.
Lime	--	178	--	Brazil 133; Chile 45.
Magnesium compounds: Magnesite, crude	50	1	--	All from Brazil.
Nitrates, crude	--	15	--	All from Chile.
Phosphates, crude	2	--		
Pigments, mineral: Iron oxides and hydroxides, processed	45	81	--	West Germany 52; Belgium-Luxembourg 12; Argentina 8.
Precious and semiprecious stones other than diamond, synthetic value, thousands	--	$4	--	All from France.
Pyrite, unroasted	--	10	10	
Salt and brine value, thousands	$4	$1	--	All from Panama.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	5,317	1,762	1,394	West Germany 363; Brazil 5.
Sulfate, manufactured	1,114	1,087	1	Peru 501; West Germany 361; Argentina 166.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	1,085	1,312	14	Brazil 1,251; Argentina 47.
Worked	--	4	--	All from Brazil.
Gravel and crushed rock	56	--		
Quartz and quartzite	27	2	--	All from Argentina.
Sand other than metal-bearing	140	56	14	Argentina 42.
Sulfur:				
Elemental: Colloidal, precipitated, sublimed	6	8	1	West Germany 5; Italy 1.
Sulfuric acid	534	88	--	Chile 60; Brazil 22; West Germany 6.
Talc, steatite, soapstone, pyrophyllite	18	14	--	Brazil 10; West Germany 4.
Other:				
Crude	43	37	--	Brazil 32; Ecuador 5.
Slag and dross, not metal-bearing	1	--		
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2,096	828	--	Brazil 484; Chile 344.
Carbon black	2	11	5	Argentina 4; Brazil 2.
Coal: All grades excluding briquets	960	72	--	All from Chile.
Coke and semicoke	258	154	--	Argentina 86; Colombia 38; Brazil 20.
Petroleum refinery products:				
Liquefied petroleum gas value, thousands	--	$2	$2	
Gasoline, motor 42-gallon barrels	102	68	17	Brazil 51.
Mineral jelly and wax do	2,448	3,573	464	Argentina 2,983; West Germany 102.
Kerosene and jet fuel value, thousands	--	$5	$5	
Distillate fuel oil 42-gallon barrels	--	48,565	--	All from Brazil.
Lubricants do	33,565	8,715	3,458	Brazil 3,591; Argentina 826.
Residual fuel oil do	53	--		
Bitumen and other residues do	103	--		
Bituminous mixtures do	11,241	351	12	Brazil 327; Chile 12.

[1]Table prepared by H. D. Willis. Import data for 1984 were the latest available at the time of publication.
[2]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Antimony.—The Bolivian antimony production was entirely by the private mining sector of which the medium-size mines produced 64% and the small-size mines, which includes the cooperatives, produced the remaining 36%. During 1987, Bolivia's antimony mine production increased by 4% over that of 1986 to 10,635 tons. Empresa Minera Unificada S.A. (EMUSA), operating the Chilcobija and Caracota Mines, is by far the largest producer of antimony concentrate, followed by Empresa Minera San Juan Ltda. and Empresa Minera Hermanos Bernal S.A., producer of antimony trioxide and antimony alloys at its Palala smelter in Tupiza, Potosí Department.

In September 1987, Laurel Industries of Cleveland, Ohio, the United States, made a tentative proposal to the Bolivian Government to construct an antimony trioxide smelter in Bolivia provided that there was an assured market for the output and two older antimony smelters in the country, which reportedly were operating below capacity. However, Laurel asserted that the quality of these plants' output did not meet Laurel's requirements.

Laurel was considering an association with EMUSA on this project. Bolivia has sufficient antimony reserves to supply the planned processing plant.

In 1987, the prices for clean antimony concentrates and antimony ore were on the rise. Consumers were reporting a lack of clean concentrates below $19 per ton, with some businesses booked as high as $19.75 for good Bolivian antimony. Bolivian lumpy ore of EMUSA origin had been sold at up to $23 per ton with some expectation of a $1 or $2 increase in the near future.

Chinese antimony, with its minimum 30 parts per million mercury and selenium impurity content, continues to trade at deep discounts to Bolivian and South African origin ores, although the Chinese are currently trying to push up the price for their best-quality concentrates to about $15 per ton.

Gold.—For many years prior to 1983, mining had been the principal contributor to Bolivian exports. Since then, oil and gas have edged mining into second place according to official figures. Within the mining field, tin has long been considered king, although gold, lead, silver, tungsten, and zinc have made important contributions, and until its price collapsed, tin was believed to account for 70% of the foreign exchange derived from mineral exports.

Gold has been given only passing mention in any discussion of Bolivian mining. Compared with silver and base metals, gold production has been, according to Government statistics, relatively insignificant.

Official gold production figures are inaccurate. They reflect the reported but not the actual production total and fail to account for the considerable quantities of gold that are regularly smuggled out of the country. Unofficial but more reliable estimates by industry watchers place yearly output near 20 tons (643,000 troy ounces). This puts the value of gold production in the same range as the export value of all other metals, aproximately $207 million.

Based on gold sold to BAMIN, the Ministry of Mines and Metallurgy reported that Bolivia's total gold production in 1987 was 88,585 troy ounces, an increase of 277% compared with that of 1986. The principal source of gold production in Bolivia continued to be 78 gold mining cooperatives operating in the goldfields of Guanay, Huayti, Mapiri, Teoponte, and Tipuani (north of the city of La Paz), which accounted for 82% of total production. The medium-size mining sector contributed 18% of the total output. In this sector, Inti Raymi S.A. has become the largest private gold producer in Bolivia with its open pit operation at La Joya near the city of Oruro. In 1987, Inti Raymi produced 15,458 troy ounces of gold or 98% of the medium-size mining sector's production. The U.S. Overseas Private Investment Corp. approved a loan to increase the production level to 4,000 tons of ore per day, which should bring the project into a world class mine category, a first for a hard-rock gold mine in Bolivia.

Lead, Silver, and Zinc.—Production of all three commodities was up substantially compared with that of 1986. Lead ore and concentrate increased 190% to 9,043 tons, silver was up 47%, and zinc was up 17%. Metallic lead, including alloys, output increased 10% compared with that of 1986. The medium-size mines sector was the dominant lead, silver, and zinc producer with its mines producing 72% of the lead, 52% of the silver, and 91% of the zinc. The major producers were Cía. Minera del Sur S.A. (COMSUR), Cía. Quioma S.A., and Cía. Minera Tiahuanacu Ltda. Most of the rest of the nonferrous output was by the small-size

mines and cooperatives.

COMIBOL, once the largest producer of all commodities, fell to the last category with 11% of the lead output, 28% of silver, and 7% of zinc.

An invitation issued in 1987 to prospective partners in Bolivia's much troubled Karachipampa lead-silver smelter failed to elicit any interest from smelters overseas. Despite the positive results of a feasibility study by Federal Republic of Germany consultants (Stolberg Consulting Engineers) and despite a vote of confidence from the Federal Republic of Germany Government itself in the form of a $15 millon loan, there appears to be little belief in industry circles that the plant can indeed operate economically. The Karachipampa smelter was opened officially in 1984 but operated only sporadically due to technical problems and a shortage of concentrate feed. The plant requires some 51,000 tons per year of lead-silver concentrates to produce the planned 22,000 tons per year of 99.98% refined lead and 196 tons per year of 99.92% silver. Hopes for a startup of the smelter seemed to fade at yearend, when mining officials recommended that legal proceedings be brought against those responsible for giving the Karachipampa smelter the construction approval.

Within the country, a number of old polymetallic deposits, mined in the past for their tin ores, have been developed to boost lead and silver output. Among these were the San José and San Vicente Mines. COMIBOL was also looking for mining partners for joint ventures of this kind.

During 1987, the number of medium-size mining companies that were members of the Medium Miners National Association decreased from 24 to 18 owing to shutdowns due to a depressed economic situation. Only one new mining company was admitted to the association, Empresa Minera Maragua Ltda., another lead, silver, and zinc producer.

The International Finance Corp. (IFC) of the United States was investing $1.2 million of a total of $4.5 million in a project to recover silver from old mine dumps near the El Cerro Rico de Potosí. Low-cost heap leaching will be used by Cía. Minera Concepcion S.A. an affiliate company of COMSUR. The project is expected to produce about 727,000 troy ounces of silver per year for export. This will be the first IFC-approved investment in Bolivia since 1978.

ASARCO Incorporated of the United States sold its Bolivian mining interest to COMSUR for an undisclosed amount. The sale of the Cerro Grande and Berenguela tin mines and the Quioma lead and zinc mine was completed in mid-August. Quioma was reopened in January 1987 after a shutdown of several months in 1986, but operations at Berenguela remained suspended.

Tin.—National tin output declined 22.4% from that of 1986 to about 8,000 tons, and COMIBOL production of tin barely reached 384 tons, the lowest output of tin in the past 35 years.

The collapse of the International Tin Council price support has virtually disintegrated an industry that in the past earned much of the country's foreign exchange revenue. The new leader in tin production in Bolivia was the medium-size mining sector with 68% of the total production. In second place were the small-size mines and cooperatives with 27%, while COMIBOL accounted for the remaining 5%. The decline of tin production in Bolivia was due to the continued depressed prices for tin in the international market. This resulted in the closure of several unprofitable tin mines within COMIBOL and in the private sector. There have also been serious labor conflicts as a result of the massive layoffs. Bolivia's tin is derived from hard-rock underground mines, which is expensive compared with alluvial tin dredging operations in other parts of the world, such as Brazil, Indonsia, and Malaysia.

COMIBOL's plans for increasing tin output depend largely on the success of new investments and the rehabilitation of some tin and polymetallic mines during the restructuring program announced in 1986 and put into effect in 1987.

COMIBOL was divided into the Mining and Metallurgical Divisions with mining companies placed under five regional subsidiaries. With funds from the Bolivian Government and multilateral lending organizations, COMIBOL planned a short-term rehabilitation program for seven mines and investment in reserve development and modernization of installations. By July 1987, the San José (tin-silver-lead), San Vicente (tin-silver-zinc), and Sante Fé (tin-lead-silver) Mines were back in production following rehabilitation of milling facilities and outlining of significant ore reserves. Also, the Caracoles group of tin mines—Argentina and Pacuni—were scheduled to be producing 37 tons per month of tin in concentrates by December 1987. Most recently Huanuni, the country's richest hard-rock tin mine has been rehabilitated to

process 1,000 tons per day of ore grading 1.7% tin.

Initial output was scheduled to be 200 tons per month of tin concentrate to expand to 500 to 600 tons by December 1988 with an average grade of 40% to 50% tin. One-half of the output was to go to the Vinto metallurgical complex. The next stage of the program was to include the rehabilitation of the Colquiri Mine, with an investment of $3.8 million. COMIBOL was to assist with $1.4 million, $1.0 million in the form of a loan from the World Bank and $1.4 million from the Vinto smelter in return for promised future concentrate supply. The rehabilitation plan for COMIBOL's smelting operations at Vinto were approved in 1986. Annual losses were running at $1.5 million at the smelter, which has a combined capacity of 30,000 tons per year in its high- and low-grade sections. The smelter has always operated below capacity, and in 1986-87 suffered from shortages of concentrate feed. A Federal Republic of Germany consulting firm was conducting a $10 million study to reduce the smelter's capacity in the high-grade section to 6,000 tons per year and convert its fuel from oil to natural gas. The low-grade section would be closed indefinitely.

Vinto has, during recent years, been unable to compete with foreign companies for concentrates, but now has $10 million available plus quantities of tin metal stocks that can be sold or traded for concentrates. At yearend, the tin production from the cooperatives, now working the Siglo XX tin mine at Catavi in Bolivia, was reported to have stabilized at about 400 tons per month. The cooperatives indicated that there were sufficient proven reserves to maintain this rate of output for 10 to 15 years. Present production is several times more than that achieved by COMIBOL (about 50 tons per month) during the months before COMIBOL suspended operations. This is typical of the mines that COMIBOL has relinquished to cooperatives.

Tungsten.—Bolivia's production of tungsten concentrates, heavily dependent on international metal prices, declined by almost 42% compared with that of 1986 to 638 tons of metal content. COMIBOL's production dropped from 77 tons of metal content in 1986 to zero, because of the closure of all mines due to severe ore depletion and high operating costs. Output of the medium-size mining sector decreased 30% compared with that of 1986, and production by the small-size mining sector declined by 48% below that of 1986 to 240 tons of metal content. During 1987, the International Mining Co. (IMCO) continued to be the largest tungsten producer in the country, followed by Empresa Minera San José de Berque, which has become an important tungsten producer in Bolivia with its Esmoraca, Española, La Argentina, and Pueblo Viejo Mines in Sud Chichas, Potosí Department.

INDUSTRIAL MINERALS

Industrial minerals have been traditionally of minor importance in Bolivia, although the need for them has increased tremendously during the past 15 years because of expanded markets. Bolivia has many undeveloped and various types of industrial mineral deposits, of which only a few have been studied. Such industrial mineral deposits occur widely throughout the country. It appears that Bolivia's failure to develop such deposits as quickly as some of its neighbors, especially Argentina and Chile, will limit its ability to take advantage of the opportunities. Bolivia, with huge lithium brine reserves at the Salar de Uyuni, faces the same market dilemma as the Peruvian saltpeter entrepreneurs did with iodine in 1874.

Lithium and Potassium.—Bolivia's options for its enormous brine reserves, rich in lithium, boron, potassium, and magnesium, have been reported in the technical literature to have only one processing possibility—solar pond production of a massive quantity of muriate, a smaller quantity of boric acid, and a tiny amount of lithium. With the low evaporation rates prevalent at the 4,000-meter-high Salar de Uyuni and freight rates to the Pacific Ocean that are greater than the shipside price of potassium chloride, it appears economical to develop these minerals. However, Bolivia has a small salt lake with heated surface brines containing 2.6 grams per liter of lithium located within 30 kilometers of a geothermal source that is currently being deep drilled with $13 million of Italian Government funding. Preliminary drilling indicated steam potentially clean enough for generator turbine use and adequate for use in multiple-stage vacuum evaporators. With these energy sources, a low-cost lithium carbonate production plant could be installed promptly at this location. The cash-flow generated by low-cost lithium sales could be used to fund development of the large rich core of the Salar de Uyuni, where brines containing over 3 grams per liter of

lithium can be processed. This salt marsh, with 5.5 millon tons of lithium brine reserves, is 150 kilometers from two geothermal sources and the same distance from natural gas pipelines.

Sulfur.—A shortfall in worldwide sulfur supply is likely to develop over the next 5 to 10 years, and Bolivia should be well positioned to serve the Latin America market. One of the more interesting applications for sulfur is as a direct-application fertilizer. In fact, Bolivia's central location on the South American Continent opens up the possibility of the country's becoming a regional supplier of many agricultural minerals, including sulfur, potash, gypsum, liming materials, and various micronutrients (especially boron, manganese, and zinc).

MINERAL FUELS

Natural Gas.—Output of natural gas increased slightly from that of 1986. Yacimientos Petrolíferos Fiscales Bolivianos (YPFB) Rio Grande gasfield continued to be Bolivia's largest natural gas producer, followed by Occidental Bolivian Inc.'s Porvenir Gasfield. Of the total production of natural gas, 63% was produced from YPFB gas fields and 37% by private contractors, Occidental and Tesoro Bolivia Petroleum Co.

Bolivia's domestic consumption of natural gas continued to be minimal at 9.7 billion cubic feet, 8.6% over that of 1986. The major consumers of natural gas in 1987 were the National Electrical Power Co. (ENDE), which used more than 50% of the national consumption, and the Bolivian cement industry.

Future increases in domestic consumption of natural gas are expected upon completion of the new 457-kilometer, 10- to 34-inch gas pipeline from Rio Grande, Santa Cruz, to Huaynacota-Parotani, Cochabamba. Construction of this gas pipeline started in December 1986 by Protexa S.A. of Mexico and should be completed by December 1988. Eighty-four percent of the pipeline was constructed in 1987. This pipeline will be linked to an old 164-kilometer, 6- to 34-inch pipeline from Cochabamba to Oruro and to a 208-kilometer pipeline constructed in 1986 from Oruro to La Paz. The pipeline will deliver 52 million cubic feet per day of natural gas in the Santa Cruz-Cochabamba section, 24 million cubic feet in the Cochabamba-Oruro section, and 15 million cubic feet in the Oruro-La Paz section.

The cost of the construction plus the conversion of the old pipeline was estimated at $98.6 million. The project was financed by the Inter-American Development Bank's (IDB) loan of $69 million and the remainder by YPFB.

Argentina continued to be Bolivia's sole foreign customer for natural gas. In 1987, Argentina paid cash for 40% of such imports and issued trade credits, which were mostly unused, for the remainder. After September 1987, cash was paid for 80% of imports, although the price received for natural gas was reduced by 11.5%.

Exports of natural gas to Argentina decreased 4.2% to 74.9 billion cubic feet, compared with those of 1986. Revenues from natural gas exported to Argentina decreased 30.4% below that of 1986 to $248.6 million. The reduction in revenues was due to the price reduction agreement made between Bolivia and Argentina in September 1987, this price was $3.05 per million British thermal units (Btu), 17.6% lower than the price set from January to December 1986, with an indexed price, based on a mathematical formula, used until the conclusion of the contract in 1992.

Of the natural gas produced in Bolivia, 46.4% was exported to Argentina, 6.0% was consumed domestically, 37.9% was reinjected into the gasfields, 3.4% was vented or flared, 4.4% was consumed as fuel by YPFB, and the remainder was consumed in miscellaneous uses.

Officials of the Ministry of Energy and YPFB were preparing for a technical meeting to be held in Brazil in early 1988 to define volume, price, financing, and construction procedures of a natural gas sales agreement to be presented at a meeting between the two Governments to be held in La Paz, Bolivia, sometime in July or August 1988.

Brazil expressed interest in buying 108 million cubic feet of natural gas per day from Bolivia to be used in its border State Matto Grosso. A Petróleo Brasileiro S.A. (PETROBRÁS) gas discovery and lower liquid fuel prices virtually closed the São Paulo market for Bolivian natural gas.

The idea of establishing an industrial center in Corumba, Brazil, was suggested by the U.S. Government, who reportedly expressed concern over the economic situation of Bolivia. The proposed industrial complex in Corumba, now under study, would include installation of a steel plant with an annual capacity of 1.8 million tons. It would also include a fertilizer plant and two thermoelectric plants, which would use Bolivian gas.

The U.S. Government suggestion report-

edly received immediate support from the IDB, which was prepared to help finance the industrial complex as long as it was built in Brazil and principally exported to Bolivia. Preliminary studies suggest that cost, including the 600 kilometers of the pipeline from Santa Cruz, Bolivia, to Corumba, Brazil, could total $1 billion. Bolivia officials will propose building a pipeline to provide Paraguay with natural gas in exchange for soybeans, cotton fiber, and beef. Paraguayan officials say there is high-level interest in the project, which, if approved, might be an offshoot of the existing gas pipeline between Camiri, Santa Cruz, to Argentina.

The Enron Corp., the largest natural gas pipeline company in the United States, owns Belco Petroleum Co., whose properties in Peru were expropriated by the Peruvian Government. Company officials were talking with the Bolivian Government about a possible $400 million investment to develop gasfields that belong to YPFB and to construct jointly with the State Electric Power Co., a gas thermal power generating plant in Santa Cruz. Bolivia's quantified and certified natural gas reserves as of December 31, 1987, were 4.1 trillion cubic feet.

Petroleum.—Production of crude oil and condensate remained basically unchanged compared with that of 1986. The total average daily production increased after a 10-year downward trend to 18,878 barrels in 1987 from 17,587 barrels in 1986.

YPFB acted as the operating unit of the sector, performing the role of an integrated oil company from exploration to development of oilfields and gasfields. It was also the sole refiner, transporter, and retailer of all finished products in the country. YPFB may contract specialized petroleum service companies. The current petroleum law does not permit joint-venture operations between YPFB and other parties.

In 1987, YPFB received requests from several oil companies for geological data about the Bolivian Altiplano and other areas. Phillips Petroleum Co. signed an information exchange and natural assistance agreement with YPFB. Phillips was interested in the areas of Roboré and Tucavaca (130 kilometers east of Santa Cruz). Shell Exploration NV of the Netherlands was interested in the Bolivian Altiplano and has presented a proposal to YPFB. Other companies that have expressed interest in the Bolivian oil industry were Union Oil Co. of California, Amoco Petroleum Co., and Petro-Canada. Future entry of companies as operating contractors will depend upon a well-defined policy and contractual terms.

During the year, YPFB ran 1,840 kilometers of exploration seismic lines, 32% less than in 1986, and conducted 24,000 meters of drilling in 10 new exploratory oil wells, 82% more than in 1986. No exploration drilling was recorded by the two foreign oil companies' contractors. Of the exploratory wells completed in 1987, the Villamontes X-1 and X-4 and the Víbora X-1 wildcat holes were shallow discovery oil wells. The Villamontes X-2 and Itaguazurenda X-2 wildcat holes turned out to be oil producers. All of these oil wells were drilled in the southern and central districts of YPFB. Total Bolivian oil reserves (crude oil plus lease condensate), as of December 31, 1987, were 125.5 million barrels of oil, of which 111 million barrels or about 88% were YPFB's reserves and the remainder was contractors' reserves. These reserves are sufficient for Bolivia's oil consumption for the next 14 years.

The high probability of finding natural gas instead of crude oil, the limited natural gas export market, and current oil market conditions reduce Bolivia's attractiveness for exploration by foreign companies. There also have been delays in revising the contracts of Occidental and Tesoro and in resolving payment issues. These factors have made it difficult for the Government to attract new exploration capital. Nevertheless, some companies have signed information exchanges and mutual assistance agreements with YPFB.

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[1]Physcial scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Bolivianos ($b) to U.S. dollars at the rate of $b2.22 = US$1.00.

The Mineral Industry of Botswana

By Thomas O. Glover[1]

The value of minerals produced in Botswana in 1987 exceeded the 1986 value by 9.2% in terms of the pula, the local currency; however, in terms of the U.S. dollar, the value rose 20.8%. Average exchange rates rose from 1.86 pula to 1.68 pula per dollar from 1986 to 1987.

Botswana averaged a real growth rate of more than 12% per year over the past 10 years. The gross domestic product (GDP) in Botswana for 1987 indicated an additional real economic growth of 8.7%, which was expected to yield a per capita GDP of $1,666.[2] Real GDP growth in Botswana was among the fastest in the developing world. In addition, the national cost-of-living index increase was reduced to 8.1% during 1987, compared to double-digit inflation in neighboring countries.

Minerals continued to be the backbone of the economy. An output of 13.2 million carats of diamonds provided the Government with 88% revenue from minerals. The revenue was enhanced by the appreciation of the value of the pula over the dollar. The Government of Botswana obtained about 78% of the De Beers Botswana Mining Co. Ltd. (Pty.) (Debswana) diamond profits. Diamond sales accounted for 57% of all Government revenues.

Botswana's growing prosperity and its sustained economic growth have led to a slow decline in the number of Botswana citizens seeking employment in the Republic of South Africa. South African mining employment has traditionally attracted thousands of young Botswana every year owing to the lack of work opportunity at home. To develop its own mineral potential, the Botswana Department of Labor established procedures under which registers of job seekers were kept, and those with mining experience in the Republic of South Africa were selected for mineral development projects within Botswana. Formal employment within Botswana has grown by an average of 8% per year for the past 21 years. South African mining employment in 1987 accounted for 19% of all formal employment compared with 40% in 1956. The formal employment sector in Botswana absorbs only 20% of the entire labor force.

One of the problems with the economy was the lack of transportation in Botswana. Most of the 1 million population was concentrated near the main rail and road trunk routes along the eastern border of Botswana. The rail system, approximately 400 miles in length, runs from Plumtree on the Zimbabwean border to Ramatlamba on the southern border with the Republic of South Africa. The rail network was operated by the National Railways of Zimbabwe during 1987, even though Botswana was scheduled to operate the rail network starting in January 1987. The changeover was postponed for administrative reasons. Most of the rail traffic proceeds through the Republic of South Africa to and from Botswana. The nickel-copper matte that was exported to Zimbabwe during 1987 for its Eiffel Flats refinery went by rail through Zimbabwe to the refinery.

A $150 million coal-fired power station near Morupule, Botswana, opened on May 4, 1987, and Botswana became self-sufficient in power generation for the first time. Six power units were scheduled to be built at the site, for which sufficient water will be available. Approximately 230 miles of transmission lines connect the power station to generation facilities at Gaborone and Selebi-Phikwe.

PRODUCTION AND TRADE

The value of mineral production in Botswana amounted to $810 million, approximately $139 million more than 1986 production. The only major production increases were in coal and crushed stone; however, owing to the rising value of the pula against the U.S. dollar, values per unit of measure were greater. Coal production increased by 16.0% with the value increasing 22.3% from $8.89 per ton in 1986 to $10.40 per ton in 1987. The production of diamonds increased only slightly compared with that of 1986; however, the value increased 8.6%. Diamonds that were classifed as industrial prior to 1986 were, for the second year in a row, processed by developing countries as gem diamond. Gold and silver production, even though small by world standards, increased by 25.8% over 1986 production. Lime, sand and gravel, and stone production all increased in 1987. The production of copper-nickel matte decreased by 16.0% in 1987 compared with that of 1986.

Exports were expected to total $1.2 billion in 1987 compared with $1.0 billion in 1986. Imports were expected to reach $866.6 million, up slightly from $804.7 million in 1986. Diamonds again led export earnings, with Europe accounting for 78.0% of exports by destination. Three-fourths of all imports were from the Southern African Customs Union (SACU). The Government's share of SACU revenue was expected to be $140.5 million compared with $111.4 million in 1986.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
Coal, not further described	395,127	392,851	437,053	499,400	579,409
Cobalt, Co content of nickel-copper (smelter product)[2 3]	223	259	222	162	182
Copper:					
Mine output, Cu content[4]	24,411	25,868	26,134	25,707	22,812
Cu content of nickel-copper (smelter product)[3]	20,261	21,471	21,692	21,337	18,934
Diamond:					
Gem[e] thousand carats	4,829	5,778	6,318	9,610	9,367
Industrial stones[e] do.	5,902	7,104	6,317	3,500	3,840
Total do.	10,731	12,882	12,635	13,110	13,207
Gem stones, semiprecious, rough, not further described kilograms	[e]35	37	14	5	40
Gold troy ounces	354	[e]480	[e]355	[e]65	[4]1,029
Nickel:					
Mine output, Ni content[5]	21,431	21,887	23,018	22,320	19,456
Ni content of nickel-copper (smelter product)[3]	18,216	18,604	19,565	18,972	16,538
Nickel-copper matte, gross weight	48,083	51,845	51,507	51,507	43,238
Sand and gravel cubic meters	[e]180,000	188,498	102,524	129,181	[e]159,000
Silver troy ounces	64	[e]95	[e]65	[e]130	([6])
Stone, crushed, not further described do.	[e]425,000	436,604	132,966	177,792	217,675

[e]Estimated. [p]Preliminary.

[1]Table includes data available through May 3, 1988.

[2]Figures approximate recoverable mine output and have been used in world production tables appearing in Volume I of the Minerals Yearbook.

[3]Smelter product was a combination of matte and pellets in 1983 and all pellets in 1984-87.

[4]Includes silver.

[5]Analytic content of ore milled.

[6]Included in reported gold figure.

COMMODITY REVIEW

METALS

Cobalt-Copper-Nickel.—The Selebi and Phikwe sulfide ore mines in eastern Botswana near Francistown were the sole source of the copper-nickel matte produced in Botswana. After sulfide ores were mined and concentrated the concentrates were put through a smelter near the mines where the matte was produced in pellet form. The product was then shipped to Norway and Zimbabwe. Matte production decreased by 16.0% compared with that of 1986. The value of the matte was 18.9% more in 1987 compared with that of 1986 owing to higher metal prices during the year. Approximately 38,000 tons of copper-nickel matte was shipped to Norway's Kristiansand refinery belonging to Canada's Falconbridge Ltd. The remaining matte was shipped to Zimbabwe's Eiffel Flats refinery. During the first half of the year, mining operations at both mines continued satisfactorily, but the deterioration of the company's flash furnace adversely affected matte production during the same period. On May 19, 1987, the flash furnace was taken off-line for overhaul. Repairs to the furnace were completed in 55 days at a cost of $7.7 million. Concentrates were still being produced during the furnace shutdown for later matte production.

Production of copper from the matte decreased 11.3% compared with that of 1986, while production of nickel decreased 12.8%, and production of cobalt increased 12.3%.

Gold and Silver.—All of the more important gold occurrences in Botswana are found in the northeastern corner of the country around Francistown. The discoveries predate European exploration activities, and only 1 of the 45 gold mines recorded was founded after colonialization. Only about 193,000 troy ounces of gold was produced by all of the mines up to 1963. After 1963, the gold industry essentially vanished from Botswana.

Currently, the gold areas are being revived with known areas of gold mineralization covered by prospecting licenses or mining permits. Production of 1,029 ounces in 1987 was 25.8% greater than that produced in 1986. At the end of 1987, a lease was granted permitting gold mining at Map Nora, in the Tati Belt near Francistown. The operation was financed by the Botswana Government, Falconbridge Ltd., and Phelps Dodge Corp. It is expected to create 200 jobs and produce gold worth an estimated $10 million per year.

Platinum.—New platinum mining prospects in the Molopo River areas of southern Botswana were explored during the year. Geologically, the prospect appeared to be a newly discovered arm of the Bushveld igneous complex in the central Transvaal of the Republic of South Africa. Exploration drilling commenced in 1987, and platinum and palladium grades of approximately 0.03 troy ounce per ton were reported. The main company involved in the region was Gold Fields Botswana, a subsidiary of Gold Fields of South Africa Ltd., which possessed three of the five prospecting licenses. The other two prospecting licenses were held by Molopo Australia, a company formed jointly by Paringa Mining and Exploration and Southern Prospecting International. All mineral rights in Botswana belong to the state. Licenses are granted only for limited periods and are renewed only if the Government is convinced that the licensees are making real progress on the prospect. If the deposits prove to be viable, they will be swiftly exploited.

INDUSTRIAL MINERALS

Cement.—Pretoria Portland Cement Ltd. (PPC), in a joint venture with United Kingdom Associates, was selected by the Botswana Development Corp. to investigate and report on the use of fly ash for producing cement in Botswana. The fly ash byproduct would be produced at the Morupule power station near Palapye. The fly ash would be interground with Zimbabwean clinker to produce quality cement.

Diamond.—De Beers Consolidated Mines Ltd., a Republic of South Africa company, issued 20 million new shares (worth more than $370 million) and made an unspecified cash payment to Debswana, a 50-50 joint venture of De Beers and the Botswana Government. Debswana thereby acquired two directors on boards of De Beers and of its London-based sales arm. De Beers got control of the diamond stockpile accumulated in 1982-85. De Beers strengthened its dominant position in the world diamond market, and Botswana gained a voice in the international diamond industry.

As part of the deal with Botswana, Debswana renewed De Beers' contract to distribute diamonds produced in Botswana.

The combined output of the three diamond mines operated by Debswana totaled 15.3 million tons of material yielding 13.2 million carats compared with 15.2 million tons of material yielding 13.1 million carats in 1986.

The Orapa Mine treated 7.3 million tons of material that yielded 4.9 million carats of diamond. Mining operations took place over the northern and southern sectors of the kimberlite pipe.

The Letlhakane Mine treated 2.5 million tons of material that yielded 632,798 carats of diamond. Mining operations were carried out in both the D/K1 and D/K2 pits. A program to increase the rate of ore treated at the Letlhakane Mine by approximately 20% was initiated during the year.

The Jwaneng Mine treated 5.4 million tons of material that yielded 7.6 million carats of diamond. Mining operations continued mainly in the central lobe; however, during the second half of the year, lower grade ore from the northeastern smaller lobe was blended for plant feed. Overburden removal continued to maintain adequate ore exposure.

Soda Ash.—Substantial discussions were held between the Republic of South Africa and Botswana on the exploitation of the Sua Pan soda ash deposits in Botswana during the year. The project would produce an estimated 300,000 tons of soda ash. It would be mainly marketed in the Republic of South Africa, with lesser amounts going to Zambia and Zimbabwe. The soda ash would primarily be used in the manufacture of glass, paper, and steel.

MINERAL FUELS

Coal.—Charbonnages de France International Botswana has carried out very important coal prospecting in Botswana since 1981. Coal-bearing formations belong to the Karoo Group. The prospecting areas were situated approximately 100 kilometers north of Gaborone, near the existing railway line. In addition to sophisticated geological evaluation techniques, 30,000 meters of exploration holes were drilled. Rotary drilling in Kalahari sands, down-hole in overburden, and coring in coal formations were used in the exploration drilling. Coal resources were estimated to be approximately 1 billion tons of steam coal.

Botswana's only operating coal mine was the Morupule surface mine. The mine, developed by Anglo American Coal Corp. Ltd. (Amcoal) supplied the Selebi-Phikwe smelter, its surrounding area, and a 90-megawatt powerplant that opened May 4, 1987. The final cost for the new power facility was $165 million. The power station was linked to a new eastern grid for Gaborone and two of the operating diamond mines. Botswana became self-sufficient in power for the first time after completion of the new power station. Additional power units under construction during the year were scheduled for completion in 1989.

Production of coal increased by 16% over that of 1986 with values increasing by 22%. The value of coal at the mine in 1987 was $10.40 per ton.

Petroleum.—Botswana undertook an integrated geophysical survey of three areas in the extreme southwest part of the country. The areas that may hold oil and natural gas are deep sedimentary basins with possible depths as much as 15 kilometers. The areas were the Ncojane and Nosop Basins in the western Kalahari and the Passarge Basin, situated centrally in the desert south of Maun. Sonics Exploration Co., Calgary, Alberta, Canada, was scheduled to commence seismic tests in the Ncojane Basin in 1988. Aerial tests for oil and gas in both the Ncojane and Nosop Basins were scheduled soon after the seismic tests in the Ncojane Basin. The tests were to be paid for under a Canadian aid program to Botswana.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Botswana pula (P) to U.S. dollars at the rate of P1 = US$0.5960.

The Mineral Industry of Brazil

By H. Robert Ensminger[1]

In 1987, the mining sector grew by 3.5%, a rate almost identical to the growth rate of 3.6% in 1986. For the second consecutive year, the growth rate was well below the rates for 1984 and 1985. The gross domestic product (GDP) for 1987 reached $278.4 billion at current prices,[2] an increase of 3.5% from the previous year. The inflation rate for 1987 was 364%, the highest level ever attained in the history of Brazil.

In August, the Presidents of Brazil and Mexico met to discuss improvement of trade between the two countries and other Latin American countries; the foreign debt was also discussed. At yearend, several accords were signed by Government representatives of the Soviet Union and Brazil, providing for use of Soviet technology to extract gold, molybdenum, and copper from the residues of the joint ferromanganese project in the Carajas region. In a midyear accord, the Chinese National Coal Import and Export Corp. agreed to provide the Brazilian state steel companies with 300,000 tons per year (tpy) of coking coal. The duration of the accord was not reported. Because Brazil had accumulated a sizable surplus in its trade with China, the Chinese Government had insisted that Brazil increase imports from China, especially iron and steel products.

Early in the year, Zaire's President signed an agreement with the Brazilian construction company, Andrade-Gutierrez, for the construction of a gold mining facility in the Kilo-Moto region of Zaire. Zaire would put up $110 million, the African Development Bank would lend $65 million, and the foreign trade department of the Banco do Brasil would provide a line of credit for the purchase of Brazilian equipment. The mine, scheduled to begin production in 1990 with a planned capacity of 55 tpy, would be operated by Andrade-Gutierrez.

Government Policies and Programs.—In 1987, the Constitutional Assembly began writing a new national constitution. A part of the constitution being considered concerned foreign investment in development of natural resources, including mining, processing, and selling minerals found in Brazil. The proposed restrictions on commercial mining on Indian and border lands would very likely restrict foreign investors more than domestic firms. If enacted, regulations for "garimpeiros" (individual prospectors) would transfer to the garimpeiros some rights enjoyed by mining companies. In November, the coordinating committee of the Constitutional Assembly approved a clause in the proposed constitution that would dilute the state petroleum monopoly, Petróleo Brasileiro S.A. (PETROBRÁS). The change would make it possible for companies other than PETROBRÁS to engage in the sale and distribution of all petroleum products, but only companies with majority Brazilian ownership. This proposed ownership clause would also apply to all minerals mined and produced in Brazil. Companies owned mostly by foreign companies or investors would be given a 5-year grace period to transfer majority ownership to Brazilian owned companies and/or Brazilian investors.

The Government's pig iron plan, which was drawn up in early 1987, was viewed skeptically in most trading circles, especially in Europe. The plan reduced the amount of pig iron to be retained for domestic consumption, thus freeing larger stocks for export. The world economic factors that generated the skepticism were slack demand, weak scrap prices, and competition from smaller suppliers such as Iran and

Turkey. Brazil's Institute of Nuclear Energy, a research arm of the National Commission for Nuclear Energy (CNEN), began pilot plant production of beryllium metal in midyear. The metal is used as a neutron reflector and moderator in the institute's project to make a reactor to produce radioisotopes.

In midyear, the Government instituted new policies governing the sale of garimpeiro gold production. Garimpeiros were allowed to use the monetary correction between the acquisition price of gold and its selling price as the basis of calculating income tax. In addition, the tax liability was restricted to just a portion of the real profits. In September, financial institutions that could use gold transactions were allowed to buy the metal in the garimpeiro regions.

PRODUCTION

Output by the Brazilian mineral sector during the last several years was adversely affected by weak international demand for its principal export commodities and the difficulties of the Brazilian domestic economy. The weak markets for iron ore, aluminum, and columbium, plus poor markets for minerals in general, held down prices, production, and exports in 1987. However, production and export prospects looked much better for the near future as demand and prices for aluminum, steel, and tin appeared to be on the rise. Demand sharply increased for copper and nickel.

In the past several years, Brazil had become a major producer of aluminum and bauxite, gold, steel, tin, and titanium in addition to continuing its leadership in iron ore.

The mining industry production index, which is based on the performance of 19 mineral commodities representing 80% of the total mineral production value, showed a growth of 3.5% for 1987 over that of 1986. The total mineral production value for the year was $8.8 billion, which represented 3.2% of the GDP.

Brazil's iron ore production, especially that of its leading producer Cia. Vale do Rio Doce (CVRD), was sustained by the expansion of the Carajas Project; output from the traditional producing areas in the central-south region had declined. The iron ore production from the Carajas region increased by 70% over that of 1986.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Bauxite, dry basis, gross weight	5,238,700	6,433,100	5,846,000	6,544,000	7,250,400
Alumina	786,648	891,300	1,095,900	1,196,800	1,326,000
Metal:					
Primary	400,744	454,999	549,167	757,584	[3]844,900
Secondary	43,016	48,946	44,828	47,971	47,000
Beryllium: Beryl concentrate, gross weight	943	1,407	877	907	1,000
Cadmium: Metal, primary	189	225	124	136	230
Chromium:					
Crude ore	468,737	709,000	727,000	[e]780,000	780,000
Concentrate	110,978	128,910	130,696	129,000	[3]123,900
Marketable product[4]	155,022	255,914	189,504	222,990	220,000
Columbium-tantalum ores and concentrates, gross weight:					
Columbite and tantalite	264	170	267	274	300
Djalmaite concentrate	7	10	10	10	10
Pyrochlore concentrate	[r]16,828	[r]27,775	29,400	28,737	[3]26,666
Copper:					
Mine output, Cu content	32,077	35,212	41,000	36,200	37,800
Metal:					
Primary	63,083	61,334	93,900	115,990	139,900
Secondary	39,920	36,000	49,000	50,000	50,000
Gold:[e 5]					
Mine output, troy ounces	199,000	214,000	700,000	[r]767,000	1,008,000
Garimpeiros (prospectors), do.	1,651,000	1,686,000	[r]1,500,000	[3]1,533,000	1,292,000
Total, do.	[r]1,850,000	[r]1,900,000	[r]2,200,000	[r]2,300,000	2,300,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS —Continued					
Iron and steel:					
Ore and concentrate, (marketable product):[4]					
Gross weight thousand tons	88,716	112,133	128,251	132,288	[3]131,600
Fe content do	57,980	72,900	[e]87,200	89,956	[3]89,500
Metal:					
Pig iron[6] do	12,945	17,200	18,970	20,350	[3]20,313
Ferroalloys, electric-furnace:					
Chromium metal	7	123	124	138	[3]123
Ferroboron	--	11	29	35	--
Ferrocalcium silicon	7,400	17,755	22,179	23,715	[3]25,673
Ferrochromium	77,326	125,125	127,288	109,392	[3]105,394
Ferrochromium-silicon	5,526	7,628	8,875	9,512	[3]8,079
Ferrocolumbium	9,665	16,522	17,676	17,391	[3]10,880
Ferromanganese	103,271	106,459	134,835	164,093	[3]155,252
Ferromolybdenum	126	437	509	511	[3]422
Ferronickel	[r]30,012	[r]33,661	33,460	34,296	[3]35,496
Ferrophosphorus	1,211	926	1,281	1,461	[3]1,784
Ferrosilicon	[r]139,005	[r]151,101	181,784	217,715	[3]231,159
Ferrosilicon magnesium	10,698	15,429	14,876	13,053	[3]17,575
Ferrosilicon zirconium	85	244	421	852	[3]398
Ferrotitanium	166	551	1,372	755	[3]80
Ferrotungsten	228	239	218	173	[3]123
Ferrovanadium	102	456	905	439	[3]88
Inoculant	[r]1,032	1,992	1,748	3,244	[3]3,308
Silicomanganese	[r]178,266	185,631	180,271	177,568	[3]188,022
Silicon metal	20,602	26,783	29,477	37,077	[3]39,982
Total	[r]584,728	[r]691,073	757,328	811,420	[3]823,838
Steel, crude, excluding castings thousand tons	12,486	16,680	18,557	20,014	[3]22,231
Semimanufactures, flat and nonflat do	14,660	18,385	20,457	21,234	[3]23,000
Lead:					
Mine output, Pb content	18,821	16,692	20,712	17,384	[3]14,700
Metal:					
Primary	20,581	25,965	29,811	32,718	[3]28,800
Secondary	28,939	45,656	51,764	38,924	[3]45,400
Manganese ore and concentrate, marketable, gross weight[4]	2,091,631	[r]2,693,131	2,523,194	2,600,000	[3]2,400,000
Nickel:					
Mine output, Ni content	15,561	23,532	20,300	13,465	13,300
Ferronickel, Ni content	8,314	9,187	13,318	13,463	13,500
Rare-earth metals: Monazite concentrate, gross weight	5,256	3,622	1,895	1,947	[3]2,000
Silver[7] thousand troy ounces	1,772	2,275	3,018	3,500	3,550
Tin:					
Mine output, Sn content	13,275	19,957	26,514	26,246	[3]27,364
Metal, smelter, primary	12,950	18,877	24,701	24,427	[3]29,365
Titanium concentrates, gross weight:					
Ilmenite	30,452	40,945	76,354	75,472	75,000
Rutile	463	412	713	495	500
Tungsten, mine output, W content	1,026	1,037	1,090	875	[3]672
Zinc:					
Concentrate and salable ore	662,126	573,260	573,166	[e]650,000	675,000
Mine output, Zn content	118,600	113,691	123,811	123,942	[3]119,400
Metal, smelter:					
Primary	999,913	106,927	116,136	129,659	138,000
Secondary	11,045	7,522	4,601	5,936	6,000
Zirconium: Zircon concentrate, gross weight[8]	7,431	6,375	21,039	13,351	15,000
INDUSTRIAL MINERALS					
Asbestos:					
Crude ore	2,090,472	1,889,326	2,254,922	[r e]2,000,000	2,000,000
Fiber	158,855	134,788	165,446	204,460	227,200
Barite:					
Crude	69,341	101,301	83,817	102,708	105,000
Beneficiated	100,106	104,920	125,957	108,328	110,000
Marketable product[4]	127,039	143,173	142,575	[e]150,000	150,000
Calcite	48,993	48,915	56,798	[e]50,000	50,000
Cement, hydraulic thousand tons	20,870	19,741	20,612	25,297	[3]25,470

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Clays:					
Bentonite	128,691	201,025	236,021	206,021	210,000
Kaolin:					
Crude	1,241,252	1,569,063	2,156,787	2,196,256	2,200,000
Beneficiated	420,120	486,359	524,182	533,800	657,600
Marketable product[4]	504,706	596,688	655,205	[e]650,000	700,000
Other:					
Crude thousand tons	21,784	22,477	[e]23,000	[e]25,000	25,000
Beneficiated do	1,034	984	[e]1,000	[e]1,000	1,000
Diamond:[e]					
Gem thousand carats	80	200	[3]233	[3]310	320
Industrial do	450	550	[3]217	[3]315	325
Total[9] do	530	750	[3]450	[3]625	645
Diatomite:					
Crude	22,431	9,069	24,387	[e]35,000	25,000
Beneficiated	14,310	16,029	17,463	19,601	20,000
Marketable product[4]	8,678	7,721	12,731	[e]15,000	20,000
Feldspar and related materials:					
Feldspar, marketable product[4]	111,837	105,491	110,150	120,572	120,000
Leucite, marketable product[4]	3,588	3,680	2,567	[e]3,000	3,000
Sodalite, crude, marketable product	845	1,214	1,077	1,200	1,200
Total	116,270	110,385	113,794	[r e]124,772	124,200
Fluorspar:					
Crude	239,522	368,130	276,623	234,944	250,000
Concentrates, marketable product:					
Acid-grade	43,943	44,341	42,681	53,560	[3]58,736
Metallurgical-grade	26,685	31,369	29,714	31,015	[3]31,212
Total	70,628	75,710	72,395	84,575	[3]89,948
Graphite:					
Crude	442,810	290,007	191,823	462,815	450,000
Marketable product:					
Direct-shipping crude ore	11,138	2,633	16,425	19,074	20,000
Concentrate	16,498	30,047	27,239	28,586	31,000
Total	27,636	32,680	43,664	47,660	51,000
Gypsum and anhydrite, crude	555,907	493,732	560,077	706,463	823,978
Kyanite:					
Crude	735	1,587	2,800	1,489	1,500
Marketable product[4]	526	1,290	2,350	950	1,000
Lime, hydrated and quicklime[e] thousand tons	[e]5,000	4,584	4,767	4,909	[3]5,300
Lithium mineral concentrates:					
Amblygonite	113	[3]49	32	[3]49	50
Lepidolite	1	[3]18	[3]26	[3]30	30
Petalite	1,892	[3]477	[3]1,323	[3]1,614	1,600
Spodumene	116	[3]288	[3]107	[3]366	300
Total	2,122	[3]822	[3]1,488	[3]2,059	1,980
Magnesite:					
Crude	48,374	724,280	623,330	648,752	[3]778,502
Beneficiated	231,000	321,643	260,754	296,792	[3]383,378
Mica, all grades[10]	3,595	4,007	2,881	2,185	2,500
Nitrogen: N content of ammonia	738,100	873,800	944,900	1,358,600	[3]1,388,100
Phosphate rock including apatite:					
Crude:					
Mine product thousand tons	19,898	22,704	23,698	[e]27,000	27,000
Of which, sold directly do	32	29	23	[e]35	35
Concentrate:					
Gross weight do	3,208	[r]3,855	4,148	4,509	[3]4,777
P_2O_5 content do	[r]1,122	[r]1,345	1,496	1,620	[3]1,694
Pigments, mineral: Other, crude	[r]4,073	[r]5,450	6,320	5,474	6,000
Potash: Marketable product (K_2O)	--	--	--	17,542	30,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Precious and semiprecious stones except diamond, crude and worked:[10]					
Agate kilograms	966,095	1,671,287	2,067,267	r e1,850,000	2,000,000
Amethyst do	244,269	336,341	472,652	r e360,000	400,000
Aquamarine do	4,727	10,238	17,012	e17,000	17,000
Cat's-eye do	2	220	--	--	--
Citrine do	30,572	30,244	63,077	r e38,000	45,000
Emerald do	9,640	6,259	5,133	r e8,000	8,000
Garnet do	241	313	--	--	--
Opal do	48	679	334	e650	650
Ruby value	$17,868	$17,455	$29,440	$987	$10,000
Sapphire do	$9,814	$14,613	$31,767	$2,474	$15,000
Topaz kilograms	3,822	440	6,567	r e3,000	3,000
Tourmaline do	12,498	5,577	12,659	r e9,000	9,000
Turquoise value	$1,051	--	--	--	--
Other kilograms	620,769	544,593	e600,000	e650,000	650,000
Quartz crystal, all grades	9,681	4,727	7,456	4,214	3,371
Salt:					
Marine thousand tons	3,259	3,578	1,734	1,600	3,600
Rock do	928	950	995	600	600
Silica (silex)	2,200	1,479	2,024	e2,500	2,500
Sodium compounds:					
Caustic soda	875,000	950,000	e950,000	e975,000	975,000
Soda ash, manufactured (barilla)	210,000	215,000	179,000	e225,000	225,000
Stone, sand and gravel:					
Dimension stone:					
Marble, rough-cut cubic meters	141,280	174,531	232,797	r e175,000	200,000
Slate	98,009	60,801	45,779	r e75,000	75,000
Crushed and broken stone:					
Basalt cubic meters	153,733	484,302	491,000	e500,000	500,000
Calcareous shells	1,214,171	994,545	883,282	e1,000,000	1,000,000
Dolomite thousand tons	1,714	1,917	2,208	r e2,000	2,000
Gneiss cubic meters	190,563	376,001	363,421	e375,000	375,000
Granite thousand cubic meters	35,261	38,815	38,817	e40,000	40,000
Limestone thousand tons	44,918	r45,757	36,329	e40,000	40,000
Quartz[11]	83,590	109,964	113,282	r e105,000	110,000
Quartzite:					
Crude	250,352	235,314	268,560	e275,000	275,000
Processed	93,246	100,825	169,120	e170,000	175,000
Sand thousand cubic meters	24,450	24,957	e30,000	e30,000	30,000
Sulfur:					
Frasch thousand tons	r3,200	r3,596	4,277	5,642	5,742
Pyrites do	r75,950	r88,983	91,080	91,596	76,704
Byproduct:					
Metallurgy do	r43,993	r52,403	79,002	100,033	153,038
Petroleum do	r65,462	r71,287	54,591	73,572	77,322
Total do	r188,605	r216,269	228,950	270,843	312,806
Talc and related materials:					
Talc, marketable product[4]	326,145	348,915	343,647	370,000	375,000
Pyrophyllite, marketable product[4]	70,318	64,432	43,401	e50,000	50,000
Other: Agalmatolite, marketable product	42,967	86,268	102,461	e105,000	110,000
Vermiculite:					
Crude	42,337	49,890	41,455	e50,000	50,000
Marketable product[4]	9,877	9,157	9,291	13,138	15,000
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous, marketable[4] thousand tons	6,935	7,752	7,934	7,554	8,000
Coke, metallurgical, all types do	1,247	1,315	1,396	1,416	1,500
Gas, natural: Marketed million cubic feet	141,700	173,119	193,008	199,841	209,695
Natural gas liquids thousand 42-gallon barrels	4,015	5,475	e6,500	4,586	9,529
Petroleum:					
Crude do	120,378	168,788	205,500	217,175	215,419
Refinery products:					
Gasoline do	64,300	69,999	107,675	77,015	79,000
Jet fuel do	17,600	18,000	21,900	20,075	21,000
Kerosene do	4,500	5,000	2,555	2,555	5,800

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Distillate fuel oil thousand 42-gallon barrels	113,900	126,784	128,845	142,715	148,000
Residual fuel oil do	80,300	90,000	78,110	90,520	106,000
Lubricants do	4,800	5,500	4,745	4,745	6,500
Other do	NA	NA	88,330	118,990	74,000
Refinery fuel and losses do	NA	NA	17,155	18,980	12,700
Total do	NA	NA	449,315	475,595	453,000

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

[1]Table includes data available through Sept. 1988.

[2]In addition to the commodities listed, bismuth, molybdenite, 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]Direct sales and beneficiated.

[5]Officially reported figures are as follows, in troy ounces: major mines: 1983—199,206; 1984—213,963; 1985—244,249; 1986—300,545; and 1987—421,000. Small mines (garimpos): 1983—1,526,775; 1984—982,623; 1985—698,475; 1986—1,000,000; (estimated); and 1987—1,100,000 (estimated).

[6]Includes sponge iron as follows, in thousand metric tons: 1983-255 (estimated); 1984-246 (estimated); 1985-285; (estimated); 1986—295; and 1987—300 (estimated).

[7]Officially reported output; of total production, the following quantities are identified as placer silver (the balance being silver content of other ores and concentrates), in thousand troy ounces: 1983—247 (revised); 1984—250; (estimated); 1985—434 (estimated); 1986—640 (estimated); and 1987—650 (estimated).

[8]Includes baddeleyite-caldasite.

[9]Figures represent officially reported output plus official Brazilian estimates of output by nonreporting miners.

[10]Exports.

[11]Apparently includes crude quartz used to produce quartz crystal (listed separately in this table) as well as additional quantities of common quartz.

TRADE

The draft of the new Brazilian constitution (see "Government Policies and Programs" section) would have an important impact on foreign investment and trade. Of particular relevance were provisions addressing the financial system, and the definition and treatment of "national" companies and of foreign capital participation in various economic areas.

The trade balance for the year showed a surplus of $11.1 billion; the mineral component showed a negative balance of $3.2 billion, almost entirely the result of petroleum imports. Mineral exports for 1987 totaled approximately $2 billion with iron ore ($1.1 billion) and bauxite ($400 million) making up 75% of the total. Total mineral imports were valued at approximately $5 billion with petroleum ($4.13 billion) representing approximately 83% of the total. The value of mineral exports made up 7% of total exports while the value of mineral imports was almost 34% of total imports.

During 1987, Argentina, Brazil, and Uruguay participated in negotiations to increase economic integration. Included in the negotiations were ambitious plans to reduce duties and remove other barriers to regional trade.

The Ministry of Mines and Energy reported Brazil and Colombia had begun discussions concerning a $700 million, 70,000-barrel-per-day petroleum refinery in Colombia. PETROBRÁS would participate in the construction of the refinery complex, and one-half of the payment for Brazil's services was to be in coal exports from Colombia.

In midyear, Brazil signed an agreement with Angola to import between 10,000 and 20,000 barrels per day of petroleum in exchange for the doubling of its lines of credit. Brazil also promised to help rehabilitate the Angolan economy beginning in 1990. The bulk of Brazil's investment would be in the construction of the 520-megawatt-capacity Kapanda Dam, in conjunction with the Soviet Union.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate thousand tons	3,317	3,113	NA	NA.
Oxides and hydroxides	94,214	41,994	NA	NA.
Metal including alloys:				
Unwrought	179,130	323,498	NA	NA.
Semimanufactures	r47,369	15,721	NA	NA.
Beryllium: Ore and concentrate	878	776	776	
Chromium:				
Ore and concentrate	6	--		
Oxides and hydroxides	30	52	NA	NA.
Metal including alloys, all forms	22	2	NA	NA.
Cobalt:				
Oxides and hydroxides	1	--		
Metal including alloys, all forms	35	5	NA	NA.
Columbium and tantalum: Ore and concentrate	270	271	NA	NA.
Copper:				
Matte and speiss including cement copper	433	391	NA	NA.
Metal including alloys:				
Unwrought	199	18	NA	NA.
Semimanufactures	r18,784	19,488	NA	NA.
Iron and steel:				
Iron ore and concentrate including roasted pyrite thousand tons	94,218	92,846	NA	NA.
Metal:				
Scrap	1	--		
Pig iron, cast iron, related materials thousand tons	2,481	2,402	NA	NA.
Ferroalloys:				
Ferroaluminum	80	--		
Ferrochromium	60,285	20,121	NA	NA.
Ferrocolumbium	14,324	12,332	NA	NA.
Ferromanganese	33,594	45,508	NA	NA.
Ferromolybdenum value, thousands	--	$2	NA	NA.
Ferronickel	9,871	4,693	NA	NA.
Ferrosilicomanganese	65,327	70,299	NA	NA.
Ferrosilicon	127,371	129,941	NA	NA.
Ferrovanadium	--	42	NA	NA
Silicon metal	22,541	26,208	NA	NA.
Unspecified	11,612	10,139	NA	NA.
Steel, primary forms thousand tons	2,493	NA		
Semimanufactures:				
Bars, rods, angles, shapes, sections do	2,003	NA		
Universals, plates, sheets do	2,215	NA		
Hoop and strip	23,274	NA		
Rails and accessories	851	NA		
Wire	41,357	NA		
Tubes, pipes, fittings	336,382	NA		
Castings and forgings, rough	10,066	NA		
Lead:				
Ore and concentrate	21	--		
Metal including alloys:				
Unwrought	1,174	592	NA	NA.
Semimanufactures	5	12	NA	NA.
Lithium: Ore and concentrate	r31	109	--	All to Japan.
Magnesium: Metal including alloys, semimanufactures kilograms	149	--		
Manganese:				
Ore and concentrate, metallurgical-grade	901,201	755,556	NA	NA.
Oxides	2,415	2,872	NA	NA.
Metal including alloys, all forms	--	19	NA	NA.
Molybdenum: Metal including alloys, semimanufactures value, thousands	$4	$3	NA	NA.
Nickel:				
Oxides and hydroxides	3	4	--	All to Ecuador.
Metal including alloys:				
Unwrought	42	46	NA	NA.
Semimanufactures	15	17	NA	NA.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, platinum troy ounces	1	547	NA	NA.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Silver: Metal including alloys, unwrought and partly wrought ___troy ounces__	4,051	5,466	NA	NA.
Tin:				
Oxides	7	1	NA	NA.
Metal including alloys:				
Unwrought	20,041	19,192	NA	NA.
Semimanufactures	11	6	NA	NA.
Titanium:				
Ore and concentrate	2,832	5,474	5,474	
Oxides ___kilograms__	1,590	--		
Metal including alloys, all forms	(2)	--		
Tungsten:				
Ore and concentrate	513	137	--	Mainly to Netherlands.
Metal including alloys, unwrought	3	--		
Vanadium: Metal including alloys, scrap	--	15	NA	NA.
Zinc:				
Oxides	12	11	NA	NA.
Metal including alloys, semimanufactures	16	35	NA	NA.
Zirconium: Ore and concentrate	--	3	--	All to Argentina.
Other:				
Oxides and hydroxides	784	733	NA	NA.
Ashes and residues	28,097	40,631	NA	NA.
Base metals including alloys, all forms	7	11	NA	NA.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	5	5	5	
Artificial:				
Corundum	32,402	35,339	NA	NA.
Silicon carbide	8,378	6,215	NA	NA.
Grinding and polishing wheels and stones	1,286	1,097	NA	NA.
Asbestos, crude	23,248	32,586	NA	NA.
Barite and witherite	7,303	6,000	--	All to Venezuela.
Boron materials:				
Crude natural borates	5	--		
Oxides and acids	15	4	NA	NA.
Cement	160,644	80,122	NA	NA.
Chalk	133	--		
Clays, crude:				
Bentonite	12	--		
Chamotte earth	35	NA		
Fuller's earth	35	10	NA	NA.
Kaolin	196,402	213,697	NA	NA.
Unspecified	1,483	2,337	NA	NA.
Diamond:				
Gem, not set or strung ___carats__	1,625	220,000	NA	NA.
Industrial stones ___do___	--	310,000	NA	NA.
Dust and powder ___do___	--	11	NA	NA.
Diatomite and other infusorial earth	23	16	NA	Mainly to Uruguay.
Feldspar	5	10	NA	Mainly to Colombia.
Fertilizer materials:				
Crude, n.e.s	1	3	--	All to Bolivia.
Manufactured:				
Ammonia	33,861	183	NA	NA.
Nitrogenous	7,392	10,756	NA	NA.
Phosphatic	1,175	4,357	NA	NA.
Potassic	2,522	4,163	NA	NA.
Unspecified and mixed	24,319	22,983	NA	NA.
Fluorspar	--	5	--	All to Venezuela.
Graphite, natural	8,725	9,416	NA	NA.
Gypsum and plaster	122	--		
Kyanite and related materials	344	135	NA	NA.
Lime	2,767	2,389	NA	NA.
Magnesium compounds:				
Magnesite, crude	12	20	NA	NA.
Oxides and hydroxides	r84,171	76,764	NA	NA.
Other	r1	10	NA	NA.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Mica:				
Crude including splittings and waste	931	1,662	NA	NA.
Worked including agglomerated splittings value	$3,897	$3,800	--	All to Uruguay.
Phosphates, crude	42	--		
Pigments, mineral: Iron oxides and hydroxides, processed	1,139	1,348	NA	NA.
Precious and semiprecious stones other than diamond:				
Natural, crude thousand kilograms	3,279	5,554	NA	NA.
Synthetic kilograms	235	1,500	NA	NA.
Salt and brine	144,581	37,798	NA	Mainly to Nigeria.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	294	1,344	NA	NA.
Sulfate, manufactured	4	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	179,538	199,184	NA	NA.
Worked	13,075	35,086	NA	NA.
Dolomite, chiefly refractory-grade	434	607	NA	NA.
Gravel and crushed rock	29	3,054	NA	NA.
Limestone other than dimension	1,608	1,763	NA	Mainly to Paraguay.
Quartz and quartzite	9,080	6,241	NA	NA.
Sand other than metal-bearing	1,913	2,385	NA	NA.
Sulfur:				
Elemental, all forms	25	8	NA	Mainly to Uruguay.
Sulfuric acid	140	102	NA	NA.
Talc, steatite, soapstone, pyrophyllite	4,135	2,216	NA	NA.
Vermiculite	137	138	NA	NA.
Other:				
Crude	r253	149	NA	NA.
Slag and dross, not metal-bearing	548	98,913	NA	NA.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	448	315	NA	NA.
Coal: All grades excluding briquets	42,348	111,136	NA	NA.
Coke and semicoke	89	90	NA	NA.
Petroleum refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	465	173	NA	NA.
Gasoline do	29,961	21,131	NA	NA.
Mineral jelly and wax do	163	288	NA	NA.
Kerosene and jet fuel do	5,834	3,082	NA	NA.
Distillate fuel oil do	6,250	3,434	NA	NA.
Lubricants do	1,177	447	NA	NA.
Nonlubricating oils do	(2)	(2)	NA	NA.
Residual fuel oil do	9,298	8,792	NA	NA.
Bitumen and other residues do	10	29	NA	NA.
Bituminous mixtures do	25	23	NA	NA.
Petroleum coke do	--	(2)	NA	NA.
Unspecified do	183	104	NA	NA.

rRevised. NA Not available.
[1]Table prepared by H. D. Willis. Source of data did not list destinations.
[2]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and rare-earth metals: Unspecified	82	205	22	United Kingdom 176; West Germany 4.
Aluminum:				
Ore and concentrate	8,801	1,022	1,002	France 10; United Kingdom 10.
Oxides and hydroxides	136,637	285,471	149	Suriname 179,206; Netherlands 56,031; Venezuela 48,155.
Metal including alloys:				
Scrap	684	3,119	3,101	Canada 18.
Unwrought	2,618	1,414	890	Italy 342; United Kingdon 75.
Semimanufactures	2,132	1,394	541	France 253; West Germany 240.
Antimony:				
Ore and concentrate	397	815	NA	NA.
Oxides	49	30	NA	NA.
Metal including alloys, all forms	483	853	NA	NA.
Arsenic: Metal including alloys, all forms	2	2	NA	Mainly from United Kingdom.
Beryllium: Metal including alloys, all forms value, thousands	$4	--		
Bismuth:				
Oxides and hydroxides	4	4	NA	NA.
Metal including alloys, all forms	31	67	NA	NA.
Cadmium:				
Oxides and hydroxides	76	120	NA	NA.
Metal including alloys, all forms	1	3	NA	NA.
Chromium:				
Ore and concentrate	14,685	10,757	--	Republic of South Africa 5,847; Philippines 4,907; Peru 2.
Oxides and hydroxides	97	73	--	West Germany 31; United Kingdom 24; Netherlands 18.
Metal including alloys, all forms	47	15	NA	NA.
Cobalt:				
Ore and concentrate	10	3	NA	NA.
Oxides and hydroxides	10	15	1	Belgium-Luxembourg 12; United Kingdom 3.
Metal including alloys, all forms	r402	584	NA	NA.
Columbium and tantalum: Metal including alloys, all forms, tantalum value, thousands	$54	$47	$32	Switzerland $6; Japan $4.
Copper:				
Ore and concentrate	164,015	261,304	--	Chile 161,666; Peru 70,638; Sweden 10,701.
Oxides and hydroxides	222	163	NA	NA.
Metal including alloys:				
Scrap	3,227	8,884	6,121	Chile 1,960; Canada 744.
Unwrought	77,480	111,148	91	Chile 93,536; Peru 8,161; Zaire 7,540.
Semimanufactures	1,473	2,165	349	West Germany 564; France 342.
Gold: Metal including alloys, unwrought and partly wrought thousand troy ounces	538	444	NA	NA.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	15	13	7	Japan 4; Switzerland 2.
Metal:				
Scrap	103,997	490,601	231,129	Netherlands 197,697; United Kingdom 59,632.
Pig iron, cast iron, related materials	29,371	2,322	1,833	Canada 343; Italy 92.
Ferroalloys:				
Ferroaluminum	(2)	--		
Ferrochromium	196	749	NA	NA.
Ferromanganese	1,284	37	--	All from France.
Ferronickel	(2)	--		
Ferrosilicochromium	--	91	NA	NA.
Ferrosilicomanganese	1,610	--		
Ferrosilicon	148	153	NA	NA.
Unspecified	69	87	87	
Steel, primary forms	NA	464,528	104,324	France 135,492; West Germany 129,640.
Semimanufactures:				
Bars, rods, angles, shapes, sections	8,396	7,683	593	Sweden 4,517; Canada 662.
Universals, plates, sheets	57,246	61,945	2,248	Venezuela 20,568; France 10,104; West Germany 9,877.
Hoop and strip	5,496	5,967	1,021	West Germany 2,818; United Kingdom 1,217.
Rails and accessories	15,928	12,199	238	Austria 6,700; Japan 4,223; Romania 407.
Wire	2,538	2,234	159	Japan 1,417; West Germany 172.
Tubes, pipes, fittings	10,553	10,961	377	Japan 3,997; West Germany 2,642; France 2,180.
Castings and forgings, rough	128	257	25	Italy 128; Japan 75.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Lead:				
Ore and concentrate	27,447	30,120	--	Ireland 10,460; Argentina 9,800; Peru 4,951.
Oxides	334	651	3	Mexico 648.
Metal including alloys:				
Scrap	12,888	16,308	14,039	Canada 1,272; United Kingdom 997.
Unwrought	2,141	3,410	--	Mexico 3,141; Peru 269.
Semimanufactures	4	3	1	West Germany 1; Italy 1.
Lithium: Oxides and hydroxides	426	388	NA	NA.
Magnesium: Metal including alloys:				
Scrap	39	--		
Unwrought	3,091	3,368	872	Norway 2,410; West Germany 85.
Semimanufactures	2	2	2	
Manganese:				
Ore and concentrate, metallurgical-grade	3,753	2,106	--	Netherlands Antilles 2,100; Republic of South Africa 6.
Oxides	66	3	2	Belgium-Luxembourg 1.
Metal including alloys, all forms	1,221	1,249	NA	NA.
Mercury 76-pound flasks	5,408	6,440	609	Netherlands 2,205; West Germany 1,653; Mexico 1,624.
Molybdenum:				
Ore and concentrate	2,893	2,493	NA	Mainly from Chile.
Oxides and hydroxides	542	484	NA	NA.
Metal including alloys:				
Scrap	2	1	NA	NA.
Unwrought	5	6	NA	NA.
Semimanufactures	43	65	NA	NA.
Nickel:				
Matte and speiss	112	3	2	United Kingdom 1.
Metal including alloys:				
Unwrought	1,133	1,912	108	Netherlands 1,157; Norway 435.
Semimanufactures	146	109	66	West Germany 26; Canada 5.
Platinum-group metals: Metals including alloys, unwrought and partly wrought troy ounces	25,592	24,113	NA	NA.
Selenium, elemental	30	38	NA	NA.
Silver:				
Ore and concentrate	5	6	NA	NA.
Metal including alloys, unwrought and partly wrought thousand troy ounces	4,329	5,466	NA	NA.
Tellurium, elemental	4	6	NA	NA.
Tin: Metal including alloys:				
Unwrought	--	24	--	All from Netherlands.
Semimanufactures	10	6	--	All from West Germany.
Titanium:				
Oxides	1,282	3,074	168	West Germany 1,427; France 766; United Kingdom 308.
Metal including alloys:				
Scrap	120	139	NA	NA.
Unwrought	20	17	NA	NA.
Semimanufactures	31	56	NA	NA.
Tungsten:				
Ore and concentrate	2,895	2,494	238	Chile 2,217; United Kingdom 20.
Metal including alloys:				
Unwrought	19	24	NA	NA.
Semimanufactures	39	39	NA	NA.
Zinc:				
Ore and concentrate	75,316	76,853	--	Peru 47,071; Sweden 9,479; Mexico 7,038.
Oxides	84	743	36	France 390; Uruguay 91; Peru 77.
Blue powder	131	158	153	West Germany 5.
Metal including alloys:				
Unwrought	23,086	23,153	--	Australia 6,910; Mexico 4,994; Spain 3,097.
Semimanufactures	5,548	46	1	West Germany 20; United Kingdom 18; Japan 6.
Zirconium:				
Ore and concentrate	12,134	12,697	NA	NA.
Metal including alloys, semimanufactures	1	--		
Other:				
Ores and concentrates	r15,099	15,118	NA	NA.
Oxides and hydroxides	17	321	2	West Germany 271; Italy 48.
Ashes and residues	20,780	18,527	3,461	Canada 15,066.
Base metals including alloys, all forms	3	177	NA	NA.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	941	518	115	Italy 340; West Germany 61.
Artificial:				
Corundum	317	275	199	France 40; Japan 20.
Silicon carbide	r1,189	948	NA	NA.
Dust and powder of precious and semiprecious stones value, thousands	$3,730	$4,906	$4,056	Ireland $533; West Germany $174.
Grinding and polishing wheels and stones	221	207	45	West Germany 56; Japan 44.
Asbestos, crude	2,591	3,658	148	Canada 2,831; Republic of South Africa 536.
Barite and witherite	22	33	--	West Germany 20; Switzerland 13.
Boron materials:				
Crude natural borates	21,699	20,731	--	Argentina 13,435; Peru 7,095; Chile 201.
Oxides and acids	5,338	6,085	3	Argentina 5,845; France 144; West Germany 81.
Bromine	14	13	NA	NA.
Cement	2,077	5,832	1,170	Uruguay 3,030; France 780.
Chalk	40	30	--	All from Switzerland.
Clays, crude	14,734	23,378	10,315	Argentina 11,897; Republic of South Africa 763.
Cryolite and chiolite kilograms	550	2,000	--	All from Switzerland.
Diamond:				
Gem, not set or strung value, thousands	$155	$524	--	Switzerland $522; West Germany $2.
Industrial stones thousand carats	$658	$725	$416	West Germany $140; Belgium-Luxembourg $91.
Dust and powder	(3)	--		
Diatomite and other infusorial earth	1,401	1,309	133	Mexico 862; West Germany 284.
Feldspar, fluorspar, related materials	1	1	--	NA.
Fertilizer materials:				
Crude, n.e.s	r18	23	--	All from Japan.
Manufactured:				
Ammonia	17,081	51,545	17,541	U.S.S.R. 33,975; France 29.
Nitrogenous	534,454	1,073,095	469,757	West Germany 196,018; Netherlands 142,626.
Phosphatic	30,789	201,372	171,621	Uruguay 23,548; Israel 6,160.
Potassic	1,799,959	2,277,351	184,612	Canada 855,340; East Germany 615,483.
Unspecified and mixed	105,598	201,086	147,192	Chile 48,305; Morocco 5,000.
Graphite, natural	8	19	--	Madagascar 18.
Gypsum and plaster	1	2	1	Italy 1.
Iodine	261	253	NA	NA.
Lime	40	70	--	All from Belgium-Luxembourg.
Magnesium compounds:				
Magnesite, crude	3	1	NA	NA.
Oxides and hydroxides	r211	160	NA	NA.
Other	323	1,214	NA	NA.
Mica:				
Crude including splittings and waste	1	25	(2)	Mainly from India.
Worked including agglomerated splittings	63	53	18	France 11; Switzerland 11.
Nitrates, crude	11,670	12,251	--	All from Chile.
Phosphates, crude	31,678	119,240	63,456	Israel 37,734; Morocco 18,050.
Phosphorus, elemental	6,163	7,718	NA	NA.
Pigments, mineral: Iron oxides and hydroxides, processed	1,048	1,104	92	West Germany 975; Italy 12.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$29	$70	$4	West Germany $64; Argentina $1.
Synthetic do.	$51	$1	--	All from West Germany.
Pyrite, unroasted	65	111	--	Do.
Salt and brine	222,568	783,352	38,000	Chile 256,999; France 140,059; Bahamas 102,460.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	110,858	155,933	80,862	West Germany 75,070; Japan 1.
Sulfate, manufactured	35,725	60,718	423	Mexico 40,268; Chile 13,724; West Germany 3,588.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	(2)	19	--	Japan 18; Greece 1.
Worked	--	6	--	All from Italy.
Dolomite, chiefly refractory-grade	351	413	--	Italy 410; Japan 3.
Gravel and crushed rock	60	60	--	All from France.
Limestone other than dimension	19	--		
Quartz and quartzite	56	13	11	France 2.
Sand other than metal-bearing	9	8	8	
Sulfur:				
Elemental:				
Crude including native and by-product	1,084,955	1,155,291	243,112	Canada 524,728; Poland 386,351.
Colloidal, precipitated, sublimed	633	791	786	West Germany 5.
Sulfuric acid	41,735	203,172	9	Spain 170,997; Italy 9,069; Switzerland 7,236.
Talc, steatite, soapstone, pyrophyllite	87	15	10	Japan 3; Sweden 2.
Other:				
Crude	7,581	9,837	491	Argentina 9,168; Greece 108.
Slag and dross, not metal-bearing	12,852	26,636	--	Republic of South Africa 26,006; West Germany 631.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	188	173	128	Argentina 45.
Carbon black	2,779	2,787	824	West Germany 893; France 582.
Coal: All grades excluding briquets thousand tons	8,260	8,946	4,955	Poland 2,113; Canada 979.
Coke and semicoke	94,610	77,300	22,060	West Germany 39,740; Japan 11,000.
Petroleum:				
Crude thousand 42-gallon barrels	197,556	219,769	--	Saudi Arabia 79,786; Iraq 71,642; China 21,479.
Refinery products:				
Liquefied petroleum gas do.	4,826	7,519	--	Saudi Arabia 3,351; Angola 2,233; Algeria 1,170.
Gasoline do.	1,221	1,017	91	Argentina 671; Uruguay 126.
Mineral jelly and wax 42-gallon barrels	541	409	47	Republic of South Africa 291; Belgium-Luxembourg 47.
Kerosene and jet fuel do.	10	543,159	--	Venezuela 244,373; Argentina 218,116; Netherlands Antilles 80,670.
Distillate fuel oil thousand 42-gallon barrels	2,481	4,953	--	Netherlands Antilles 1,354; Venezuela 1,318; Argentina 706.
Lubricants do.	841	157	30	Romania 73; Venezuela 19.
Nonlubricating oils do.	59	66	--	All from Romania.
Residual fuel oil do.	1,530	1,486	--	Venezuela 1,227; Italy 256.
Bitumen and other residues do.	(2)	(2)	--	All from Uruguay.
Petroleum coke do.	556	1,091	711	Argentina 363; United Kingdom 17.

rRevised. NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Revised to zero.

COMMODITY REVIEW

METALS

Alumina, Aluminum, and Bauxite.— Domestic production of primary aluminum was approximately 845,000 tons in 1987, which exceeded that of the previous year by 11%. Total aluminum production including secondary (scrap) aluminum was an estimated 913,000 tons. Primary aluminum exports were 463,000 tons, or 55% of primary production, making Brazil 1 of the top 10 aluminum exporters worldwide. Domestic consumption of aluminum slumped in 1987 as a result of rising inflation and cutbacks in state investment in the transport, industrial, and construction sectors. In

addition, a dispute between aluminum producers and the Government at midyear affected domestic and export sales. In October, the go-ahead was given for phase 2 of the Alumínio Brasileiro S.A. refinery project at Barcarena, Para State. Phase 2 would raise the smelter capacity to 240,000 tpy of alumina by yearend 1988, and to 320,000 tpy by 1991. The project is owned by CVRD (51%) and Nippon Amazon Aluminium Co. (49%), a Japanese consortium. Two of Brazil's largest foreign subsidiaries, Alcoa Aluminio S.A. (United States) and Pirelli S.A. (Italy) at yearend planned to form a joint venture to construct a 16,000-tpy aluminum bar-rolling plant at Pocos de Caldas, Minas Gerais State. The venture required an investment of $7 million split evenly between the two companies. Alcoa would guarantee a supply of ingot aluminum, and Pirelli would transfer equipment from a rolling plant at Santo Andre, São Paulo State.

Bauxite production for 1987 was approximately 7.3 million tons, a growth of 12% over that of the previous year. The major bauxite producer was Mineração Rio do Norte S.A., which accounted for 70% of annual production as well as 3.2 million tons of bauxite exports valued at $84 million. Brazil's alumina production for 1987 was an estimated 1.3 million tons.

Columbium.—In 1987, ferrocolumbium production decreased 40% to 10,800 tons. Total exports were reduced as well, from 12,332 tons in 1986 to 11,069 tons in 1987. The major importers were North America (37%), the European Economic Community (36%), Japan (17%), and the Soviet Union (4%). Cia. Brasileira de Metalurgia e Mineração (CBMM) produced approximately 85% of the ferrocolumbium, and Mineração Catalao de Goias Ltda. produced the remainder.

Paranapanema S.A. Mineração Indústria e Construção, Brazil's largest tin producer, constructed a columbium processing plant at its Pitinga Mine in the State of Amazonas. It began production at yearend. The plant, with annual capacity of 2 million pounds of columbium oxide, was designed to process the mine's byproduct columbium. At yearend, Brazil's Industrial Development Council approved a project by CBMM to produce approximately 40 tpy of columbium metal, mainly for use in superconductor research. The plans call for an investment of $6 million in equipment at its plant in Araxa, Minas Gerais State, with production to commence by 1990. The mine at Araxa contains sufficient proven reserves to last approximately 500 years assuming a production of 20,000 tpy of pyrochlore concentrate.

Copper.—Brazil increased its mine production by approximately 4% over that of 1986 while primary copper production increased an estimated 21% over that of 1986. Cia. Paraibuana de Metais (CPM) announced that construction would very likely begin on its 100,000-tpy electrolytic refinery near the Igarape do Salobo copper deposit in the Carajas area in 1988. The deposit contains copper sulfide reserves of 1.2 billion tons, of which 40% is in excess of 0.8% copper. Cia. Metalquimica do Maranhao, a subsidiary of CPM, received the go-ahead for its plans to construct a 100,000-tpy smelter-and-refinery facility at São Luis in the Carajas area at yearend. Construction was to commence in mid-1988. Nevertheless, no decision was reached on full-scale development of the Salobo deposit.

Gold.—Unofficial gold production in Brazil was estimated at 2.3 million troy ounces while the estimated official figure was 1.2 million ounces. In 1987, the major gold mining companies produced approximately 421,000 ounces of gold, 85% of which was produced by CVRD (Fazenda Brasileiro Project), Manati Mineração, Mineração Novo Astro, Mineração Morro Velho and São Bento Mineração. The official garimpeiro production was 730,000 ounces.

The Morro do Ouro project in the State of Minas Gerais began gold bullion production at yearend. The mine was under the operation of Rio Paracatu Mineração S.A., a joint venture of the British company Rio Tinto Zinc Corp. PLC (RTZ) (51%) and the Brazilian company Autran Mineração e Participacoes S.A. (49%). The ore reserves were estimated at 130 million tons grading 0.66 grams per ton of gold. A total of $65 million was invested in the mining operation by yearend, with the total installed capacity of 3 to 5 tpy of gold to be fulfilled in 1988. Inco Gold Co. of Canada announced that it will proceed through its Brazilian subsidiary, Mineração Serra Grande S.A., to develop its gold mine project at Crixas, Minas Gerais State. The total cost of the project will be $68 million, one-half of which is to be met by Mineração Morro Velho S.A., a subsidiary of the Anglo American Corp. of South Africa Ltd. The deposit contains reserves of 7 million tons of ore grading 11.7 grams of gold per ton.

Paranapanema, Brazil's largest tin pro-

ducer, pulled out of Mato Grosso State because its gold mining concession, the Novo Planeta Mine, was overrun by numerous garimpeiros over an extended period. The mine's annual production was 27,000 ounces, and had a total investment of $50 million.

Iron Ore.—Brazil's iron ore production is mainly concentrated in two areas, the "Iron Quadrangle" in the State of Minas Gerais and the Serra dos Carajas area in the State of Para. As production declines in the southern region, the emphasis on the Carajas region increases. Iron ore production increased slightly over that of the previous year, and CVRD produced approximately 65% (85 million tons). Iron ore exports increased by about 6% to 95.7 million tons, of which CVRD exported 65.3 million tons. Mineracoes Brasileiras Reunidas S.A. (MBR), the second-largest producer, produced an estimated 20 million tons and exported in excess of 14 million tons, or 15% of total exports. The three remaining major producers were Ferteco Mineração S.A. (10%), S.A. Mineração da Trindade (6%), and Samarco Mineração S.A. (6%). CVRD produced 17 million tons of iron ore pellets in six plants at the Tubarão harbor complex in 1987. Four of the plants are joint ventures between CVRD and international companies from Italy, Spain, and Japan. The two remaining plants are wholly owned by CVRD.

The Brazilian Government and MBR signed an agreement for the completion of the much-delayed railroad between Minas Gerais and its Sepetiba Bay terminal in Rio de Janeiro State. The railway had been under construction for the past 10 years. By the terms of the agreement, MBR will invest $70 million of the required $136 million and will recoup its investment through the use of the railroad for moving its own iron ore.

Brazil's total iron ore reserves (measured, inferred, and indicated) containing greater than 50% Fe were a reported 74 billion tons. The measured reserves were 21.5 billion tons, with 56% in the Carajas region and the remainder in the Iron Quadrangle. Measured reserves containing greater than 60% Fe were calculated to be 8.7 billion tons with the Iron Quadrangle containing 4.7 billion tons and the Carajas region the remainder.

Iron and Steel.—*Ferroalloys.*—Ferroalloy production increased by 2% over that of 1986 to approximately 824,000 tons, with ferrosilicon making up 28% of the total. Ferrochromium, ferromanganese, ferrosilicomanganese, and ferrosilicon composed 83% of the total ferroalloys produced.

Many ferroalloy producers suffered from the disruption of power supplies caused by a drought in the northern States. A number of the producers received authorization from the Government to construct their own hydroelectric powerplants. The financing, reportedly, would be by the industry itself and from international lenders. The Government would provide less than 10% of the financial backing. Energy costs were raised 45% over those of 1986, which resulted in the elevation of the energy portion of production costs to 50%. The powerplants would be built in the north, and the electricity produced sold to the Government for transmission to Minas Gerais State where most ferroalloy producers are located.

Pig Iron.—The Itaminas Group, Brazil's largest pig iron producer, formed Cia. Siderúrgica do Para (COSIPAR) to construct and operate a plant in Maraba, Para State. Itaminas will invest $70 million to reach pig iron production of 600,000 tpy in 5 years. The plans call for COSIPAR to build 10 furnaces of 60,000 tpy capacity each. Production is to begin in early 1988 using iron ore from the CVRD mine in the Carajas region.

Steel.—Brazil was the world's seventh-largest steel producer in 1987, producing approximately 22.2 million tons, 11% greater than in 1986. Exports accounted for 8.4 million tons and were valued at $1.5 billion.

Brazil's state steel holding company, Siderurgia Brasileira S.A. (SIDERBRÁS), lost approximately $2.3 billion. The Central Bank attributed the loss to a decrease in demand and to pricing problems that reduced the steel selling price below production costs. Cia. Siderúrgica Belgo-Mineira, the country's second-largest private steel producer, announced it was lowering its investment plans for 1987 and 1988. The planned 1987 investments of $83 million were reduced by 42% to $48 million due to lack of confidence in the Government's economic program, according to Belgo-Mineira. Cia. Siderúrgica Paulista, one of the state-operated steel mills and the country's third-largest, inaugurated a rebuilt high-temperature furnace and the first of three continuous casters. These improvements would boost the plant's output from 2.7 million tpy to 3.9 million tpy by early 1988.

Manganese.—Manganese production decreased by about 8% relative to 1986 output. The reduction was partly the result of reports that the Industria e Comércio de Minerios S.A. (ICOMI) manganese mine at Serra do Navio in Amapá Territory had an economic life of 5 to 6 years, and partly a reaction to adverse market conditions. These adversities also influenced the 10% drop in exports, to 690,000 tons. However, as a result of further exploration and testing, additional reserves of 2 million tons of high-grade ore were discovered at the Amapá mine. Its estimated productive life was extended to 8 to 9 years.

Metalman S.A., a subsidiary of Metalur, reportedly invested $3 million in technology for the production of manganese metal, electrolytic MnO_2, and potassium permanganate ($KMnO_4$) from the Igarapé Azul manganese mine ores in the Carajas region. A startup in early 1988 was projected.

Rapid growth in the production of manganese was expected following CVRD's activation of the Igarapé Azul Mine. The mine's officially reported reserves were 60 millon tons comprising 48.5 million tons of lump ore grading 43% Mn and 11.5 million tons of battery-grade ore with 76% Mn content.

Tin.—Tin production increased by 4%. Brazil ranked second in the world in tin production with approximately 17% of the world total. Production growth was controlled with an aim to normalizing the world tin market. For the same reason, tin exports were held to 21,000 tons, the same level as in 1986. The Brazilian Government had planned to restrict its exports of tin to 26,500 tons in 1988, in line with an agreement reached with the Association of Tin Producing Countries. As of early 1987, Brazil possessed 250,000 tons or about 8% of the world's known tin reserves, and 66% of Latin American reserves. It ranked fourth in the world in the amount of reserves after Malaysia, Indonesia, and Thailand.

Titanium.—CVRD announced plans for a $100 million project in the Tapira region of Minas Gerais State that will produce 400,000 tpy of anatase concentrate. The project was scheduled to begin production at about one-half-capacity by the end of 1989. Upland Minerals and Chemicals Corp., a Brazilian exploration and mining company, confirmed in a second series of analyses that significant reserves of titanium dioxide (TiO_2) exists on three of the company's five titanium concessions.

INDUSTRIAL MINERALS

Cement.—Brazil's cement production was 25.5 million tons compared with 25.3 million tons for 1986, and Brazil continued to be the leading cement producer in Latin America. Cement imports had increased over the past 3 years to the modest level of 16,000 tons. The cement industry had an installed capacity of 44.8 million tpy at yearend 1987. All 54 cement plants in Brazil were privately owned. All new plant activity that was scheduled to come on line in 1987 was postponed until 1988.

Phosphate Rock and Potash.—Brazil increased phosphate rock and P_2O_5 production by 6% and 5%, respectively; however, the rates of production remained well below the domestic consumption levels. To meet the increasing domestic demands for phosphates, at least $1 billion must be invested in the industry by 1990, according to the Ministry of Mines and Energy. As a direct result of this, Petroleos Fertilizantes Brasileiro S.A. (PETROFERTIL), a subsidiary of PETROBRÁS, authorized the investment of $40 million in the expansion of the Tapira Mine in Minas Gerais State, to 1.5 million tpy from 1.1 million tpy.

CBMM announced the discovery of large phosphate deposits in the vicinity of Campo Alegre de Lourdes, 820 kilometers from Salvador, Bahia State. Exploration was to be concluded in 1988, but reserves estimated by yearend were 20 million tons of 18% apatite and 50 million tons of carbonatite with 8% P_2O_5. Planned investment by CBMM would be $20 million to start up a 300,000-tpy mine and concentrator plant.

PETROFERTIL awarded a contract to Milder Kaiser Engenharia S.A. for a feasibility study on a plant to produce phosphoric acid and yellow cake (U_3O_8) commercially from the Itataia deposit. The deposit, located 240 kilometers from Fortaleza, the State capital of Ceara, was discovered in 1975. Plans called for the installation of a plant to produce 105,000 tpy of P_2O_5 and 700 tpy of U_3O_8 at an estimated investment cost of $200 million.

Petrobras Mineração S.A., the mining subsidiary of PETROBRÁS, opened Brazil's first potash mine at Taquari-Vassouras, Sergipe State in 1987. The life expectancy of the mine is 30 years at a production level of 500,000 tpy, although only 100,000 tons was produced in 1987.

MINERAL FUELS

Coal.—In 1987, Brazil marketed 7.6 million tons of coal comprising 1.4 million tons of metallurgical coal. Domestic consumption of steam coal exceeded production by about 1 million tons, while metallurgical coal imports approached 10 million tons. The National Minerals Production Department reported that the results of a survey of the Paraná River basin increased the total measured, indicated and inferred Brazilian coal reserves by 30% to 32.4 billion tons. Of this amount approximately 3 billion tons are currently recoverable. Based on current consumption rates, the country has sufficient coal for the next 2,000 years, however, most of it is of relatively low quality.

SIDERBRÁS contracted for the purchase of 11 million tons of metallurgical coal in 1987, 1 million tons more than in 1986, at a cost of approximately $600 million. Among the coal suppliers with contracts or contracts pending were the following U.S. companies: A. T. Massey Coal Co., Eastern Gas and Fuel Associates, Island Creek Corp., Jno. McCall Coal Co., Peabody Development Co., Pittston Coal Export Corp., United Coal Co., and U.S. Steel Mining Co.

The Government was considering a national coal council to oversee long-range Brazilian coal development. Early in the year, a policy meeting of coal producers, distributors, and users concluded that it was vital for coal to take a greater part in Brazil's energy profile. Participants recommended that a national policy council be created, with the federal coal distribution company, Cia. Auxiliar de Empresas Electricas Brasileiras, taking responsibility for carrying out policy. Another suggestion was that the industry welcome some international participation in order to attract foreign capital and technology.

Natural Gas.—Natural gas production increased by 5%, to nearly 210 billion cubic feet. At yearend, recoverable reserves were calculated to be 3.7 trillion cubic feet. Based on the 1987 rate of production, the reserves would last approximately 18 years.

Pecten do Brasil, a Shell Oil Co. subsidiary, signed an agreement in October to invest $200 million over the next 4 years to develop the Merluza Gasfield offshore São Paulo State. Pecten was to drill five wells from a fixed platform in 140 meters of water, and two existing wells would be completed on the seabed. Gas production would be transported 179 kilometers through a new marine pipeline and 20 kilometers of onshore line to Cubatão, São Paulo State. Upon completion of the wells, PETROBRÁS would take over operation of the field.

In February, the state gas corporation, COMGAS, began work on the São Paulo City gas distribution system. The system would be connected to the 22-inch, 320-kilometer pipeline under construction by PETROBRÁS. The line would connect Volta Redonda, Rio de Janeiro State, to Capuava, just east of São Paulo City. The pipeline would cost approximately $100 million. The President approved a plan recommending the expenditure of $3.5 billion, in addition to the $1 billion earmarked for natural gas exploration, on raising the use of natural gas in total domestic energy consumption to 5% from the current 2% share.

Petroleum.—Brazil produced 215.4 million barrels of crude petroleum, about the same as in 1986. The average daily production was approximately 590,000 barrels with 623,000 barrels being the peak rate. Recoverable reserves determined at yearend were 2.6 billion barrels. At the 1987 rate of production, the proven reserves would last approximately 12 years. In midyear, PETROBRÁS announced it may have discovered a 3.5-billion-barrel petroleum reserve in the deep portion of the Campos Basin south of the Marlim Field, which already had estimated reserves of 3.5 billion barrels lying beneath more than 600 meters of water. The discovery well was drilled in 1,100 meters of water and yielded 3,000 barrels per day of oil. PETROBRÁS completed the world's deepest offshore producing well in January. The well, completed in 492 meters of water, produced 5,000 barrels of petroleum and 2.3 million cubic feet of natural gas per day. PETROBRÁS announced that after 10 years on-stream, the petroleum and natural gas produced in the Campos Basin had spared Brazil the additional cost of imported oil by $14 billion to $15 billion, paid off the $10 billion invested, and provided profits of $4 billion to $5 billion.

Argentina, Brazil, and Chile discussed the possibility of establishing a consortium to complete the exploration and begin the exploitation of petroleum reserves on the Atlantic Continental Shelf opposite the Strait of Magellan. It was announced in April that a 155-square-kilometer oil basin had been discovered in the Urucu River area of the Amazon basin.

Reductions in the PETROBRÁS investment schedule in 1986 and 1987, which were forced by increased financial losses, began to affect investments in production facilities. With increased consumption and declining production, some sources stated

that Brazil's chances for self-sufficiency appeared dim. Prospects for production at the 700,000-barrel-per-day level by the end of 1987, once thought virtually certain, fell far short of that figure by 110,000 barrels per day.

Nuclear Power.—In October, the President announced that Brazil had succeeded in mastering the technology of uranium enrichment. CNEN had begun research into uranium enrichment in 1979 and invested $37.4 million through 1987. Brazil reportedly arranged to export 5 tons of enriched uranium worth $1.4 million to Argentina, although the new enrichment plant had not been opened. At yearend, the Japanese Government was negotiating with Brazil concerning investments in uranium prospecting and mining. The prospecting and mining would be done on a risk basis, mostly at the Cristalino River site in southern Para State. Japan would finance the cost of prospecting, which would cost several million dollars, and then import part of any uranium found.

NONMINERAL ENERGY SOURCES

Alcohol.—In 1987, Brazil produced approximately 2.7 billion gallons of alcohol which was almost entirely consumed domestically. PETROBRÁS, for the first time ever, recorded a loss in 1987 from its total operations. The loss was approximately $2 billion, of which alcohol subsidies made up approximately 15%. There had been mounting pressure on the Government to reduce the amount of the alcohol subsidy.

Hydroelectric Power.—Hydroelectric power made up almost 95% of the electricity produced in Brazil, compared with a 91% share in 1986. Thermoelectric sources (coal and oil) accounted for 4.7%, and nuclear plants, 0.6%. At yearend, it appeared that the specter of energy rationing and blackouts no longer threatened the State of Rio Grande do Sul. New financing, federal assistance, and debt restructuring were arranged to head off future electrical power shortages. Early in the year, the drought persisted in northeast Minas Gerais and southwest Bahia States. However, it eased off considerably by yearend, allowing most of the alumina and aluminum plants to go back to previous levels of production.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Brazilian cruzados (Cz$) to U.S. dollars at the rate of Cz$39.2=US$1.00 as an average for 1987.

The Mineral Industry of Bulgaria

By Walter G. Steblez[1]

In 1987, Bulgaria's mineral industry continued to meet most of the country's needs for nonferrous metals. However, Bulgaria had to rely heavily on imports to meet its needs for fuels, a variety of industrial minerals, and iron and manganese ores.

Bulgaria's centrally planned economy met most of its goals for 1987. National income rose by 5.1% and industrial production by 4.4% compared with those of 1986. On balance, the 1987 production results for the metals and raw materials industries were positive. The exception was rolled steel products, which declined in output compared with that of 1986. The Metallurgy Economic Trust failed to fulfill state orders and plans for rolled iron and steel products, and the Metal Products Economic Trust failed to fulfill state orders for the production of steel pipes.[2] The major mineral industry projects during the year were the continued construction of the Progress gas pipeline between the U.S.S.R. and Bulgaria, and the development of the Asarel copper mining and beneficiation complex. Also, during the year, a number of new products were produced for the first time; these included wire rod from high carbon steel, powdered metal products for machine building, new rolled sectional and sheet products, and castings.

Government Policies and Programs.—Bulgaria's central economic plan for 1988 called for a 6.1% increase in the growth of national income compared with that of 1987 and a 5.0% increase in the growth of industrial production for the same period. The 1988 plan laid special emphasis on increasing both the range and quality of iron and steel and nonferrous metal products. The production of high-quality structural steel was planned to reach 31% of total steel output, and total metal production, both iron and steel and nonferrous, was to increase by 7.2% compared with that of 1987.

PRODUCTION

Bulgaria's mineral industry was state-owned and operated and subject to central planning. To a large extent, most mineral production was coordinated with the U.S.S.R. and other Council of Mutual Economic Assistance (CMEA) countries not only to meet the country's needs, but also to fulfill the mineral and raw material requirements within the CMEA bloc. Most mineral industry technology and equipment was of Soviet design and/or manufacture. Mining and processing operations, with the exception of the coal mining sector, were reportedly fully mechanized in accordance with CMEA standards. In keeping with the Soviet practice of not reporting production statistics on nonferrous metals, Bulgarian data on these commodities were not available and had to be derived from official nonstatistical sources.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Cadmium metal, smelter[e]	200	200	200	200	180
Copper:[e]					
Mine output, Cu content	80,000	80,000	80,000	80,000	80,000
Metal, primary and secondary:					
Smelter	60,000	60,000	90,000	90,000	91,000
Refined	62,000	62,000	93,000	95,000	95,000
Iron and steel:					
Iron ore:					
Gross weight thousand tons	1,803	2,063	1,985	2,179	2,200
Fe content do	554	622	607	661	665
Iron concentrates do	824	913	917	986	990
Metal:					
Pig iron do	1,623	1,578	1,702	1,597	1,600
Ferroalloys, electric furnace, all types[e] do	57	49	41	48	42
Steel, crude do	2,831	2,878	2,944	2,965	2,900
Semimanufactures, rolled do	3,235	3,354	3,325	3,347	3,350
Lead:[e]					
Mine output, Pb content	95,000	95,000	95,000	95,000	97,000
Metal, smelter, primary and secondary	116,000	116,000	116,000	115,000	115,000
Manganese ore:					
Gross weight	45,000	45,000	38,000	37,000	36,000
Mn content	13,100	13,000	11,300	11,200	11,100
Molybdenum, mine output, Mo content[e]	190	190	190	190	200
Silver, mine output, Ag content[e] thousand troy ounces	930	930	930	910	910
Zinc:[e]					
Mine output, Zn content	68,000	68,000	68,000	70,000	70,000
Metal, smelter, primary and secondary	91,000	91,000	91,000	90,000	92,000
INDUSTRIAL MINERALS					
Asbestos	700	r500	400	300	300
Cement, hydraulic thousand tons	5,644	5,717	5,296	5,702	5,700
Clays, Kaolin do	242	256	257	265	270
Gypsum and anhydrite:					
Crude do	386	393	388	395	400
Calcined	116	115	113	99	110
Lime: Quicklime thousand tons	1,634	1,526	1,331	1,632	1,400
Nitrogen: N content of ammonia	1,124	1,138	1,138	e1,140	1,145
Pyrites, gross weight[e] thousand tons	189	177	153	e187	185
Salt, all types do	87	89	89	91	92
Sodium carbonate, calcined do	1,271	1,212	1,037	1,054	1,100
Sulfur:[e]					
S content of pyrites	80,000	75,000	65,000	e80,000	80,000
Byproduct, all sources	56,000	62,000	53,000	e62,000	65,000
Total	136,000	137,000	118,000	e142,000	145,000
MINERAL FUELS AND RELATED MATERIALS					
Coal, marketable:					
Anthracite thousand tons	83	84	83	80	79
Bituminous do	160	139	140	127	128
Brown do	5,342	5,519	5,385	5,119	5,200
Lignite do	26,805	26,617	25,272	29,896	30,000
Total do	32,390	32,359	30,880	35,222	35,407
Coke do	1,270	1,186	1,087	1,156	1,200
Gas, natural, marketed[e] million cubic feet	4,800	3,4,800	4,600	4,600	4,500
Petroleum, crude: As reported[e] thousand tons	1,314	1,314	1,300	1,080	1,000

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

[1]Table includes data available through Aug. 16, 1988.

[2]In addition to the commodities listed, barite, bismuth, chromite, fluorspar, gold, magnesite, palladium, platinum, tellurium, uranium, 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

The U.S.S.R. remained Bulgaria's major commercial partner and principal supplier of iron and manganese ores as well as coal, natural gas, and petroleum. In 1987, both countries continued to promote a high level of economic coordination. The Soviet Union had assisted Bulgaria in the construction of 350 industrial projects, of which 230 were operational by 1987. Also, the Soviets had agreed to assist in modernizing 115 enterprises in Bulgaria's chemical, iron and steel, machine building, and nuclear industries. Bulgaria, a country with limited raw material and fuel resources, had participated in industrial development projects in the U.S.S.R. that were largely related to iron ore and coal mining, and to petroleum and natural gas extraction to assure adequate long-term supplies of these commodities. Specific Bulgarian-Soviet agreements concluded in 1987 included a cooperative venture for the production of mining machinery that would last until the year 2000 and would expand direct contacts between organizations and enterprises of the two countries. The agreement resulted in the creation of a new Bulgarian-Soviet trust for the joint production of tools and equipment for the mining and processing industries. Also, a similar long-term agreement was reached on economic and technical cooperation in the nuclear and conventional electric power generating sectors.

Reportedly, Bulgaria and Albania expanded commercial relations in 1986 and 1987. Mineral trade between the two countries included Bulgarian exports of heavy machine durables including mining equipment to Albania in exchange for Bulgarian imports of Albanian bitumen, cement, copper cables, and sulfur. Bulgaria also expressed interest in assisting Albania in the development of its bauxite, kaolin, magnesite and quartz deposits.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ash and residue containing aluminum	1,137	1,863	--	West Germany 1,603; Italy 260.
Metal including alloys:				
Scrap	3,059	5,117	--	West Germany 3,913; Italy 1,115; Sweden 89.
Unwrought	3,923	4,058	--	Japan 2,787; Italy 806; Austria 251.
Semimanufactures	48	334	--	Yugoslavia 218; Hungary 75; France 17.
Beryllium: Metal including alloys, all forms	(2)	--		
Bismuth: Metal including alloys, all forms	15	31	--	United Kingdom 26; West Germany 4; France 1.
Cadmium: Metal including alloys, all forms	42	40	--	All to Czechoslovakia.
Copper:				
Ore and concentrate	--	23,024	--	All to Finland.
Metal including alloys:				
Scrap	418	659	--	Switzerland 294; West Germany 224; Italy 138.
Unwrought	599	504	--	Yugoslavia 294; Belgium-Luxembourg 150; West Germany 29.
Semimanufactures	1,142	832	1	Yugoslavia 587; Morocco 151; West Germany 40.
Gold:				
Waste and sweepings value, thousands	$665	--		
Metal including alloys, unwrought and partly wrought do.	$297	$400	--	All to Switzerland.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	5,484	1,687	--	All to Hungary.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal:				
Scrap	38,000	44,464	--	Yugoslavia 25,600; Greece 14,492; Italy 3,901.
Pig iron, cast iron, related materials	[3]78,900	[3]32,300	--	Yugoslavia 15,010; unspecified 17,290.
Ferroalloys:				
Ferrochromium	1,022	3,067	--	Belgium-Luxembourg 973; Netherlands 968; West Germany 471.
Ferromanganese	1,000	3,000	--	NA.
Ferrosilicomanganese	--	982	--	West Germany 957; Netherlands 25.
Ferrosilicon	370	418	--	Greece 300; West Germany 118.
Silicon metal	--	57	--	All to Italy.
Unspecified	9,934	4,533	--	West Germany 288; Austria 198; unspecified 4,087.
Steel, primary forms thousand tons	327	393	--	Italy 56; Hungary 33; Spain 33.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	72	52	--	Poland 16; Greece 7; Italy 6.
Universals, plates, sheets do	402	402	--	West Germany 36; Czechoslovakia 24; Romania 19.
Hoop and strip do	11	11	--	Greece 8; West Germany 1.
Rails and accesories do	6	(2)	--	All to Tunisia.
Wire do	61	65	--	NA.
Tubes, pipes, fittings do	44	36	--	Poland 6; West Germany 2; unspecified 27.
Castings and forgings, rough do	1	3	--	NA.
Lead:				
Oxides	1,158	100	--	All to Italy.
Metal including alloys:				
Scrap	--	1,531	--	All to Yugoslavia.
Unwrought	1,424	5,355	--	Yugoslavia 2,355; Czechoslovakia 2,000; Italy 500.
Magnesium: Metal including alloys, scrap	--	11	--	All to West Germany.
Manganese: Ore and concentrate, metallurgical-grade[3]	7,300	7,000	NA	NA.
Molybdenum: Ore and concentrate	90	--		
Nickel:				
Oxides and hydroxides	--	2	--	All to Netherlands.
Ash and residue containing nickel	26	15	--	Do.
Metal including alloys:				
Scrap	4	39	--	United Kingdom 35; Switzerland 4.
Unwrought	508	274	--	Yugoslavia 264; Netherlands 10.
Semimanufactures	63	17	--	All to Morocco.
Platinum-group metals:				
Waste and sweepings value, thousands	$182	--		
Metals including alloys, unwrought and partly wrought do	$26	$256	--	All to West Germany.
Selenium, elemental	--	2	--	All to United Kingdom.
Silver:				
Ore and concentrate value, thousands	$53	--		
Waste and sweepings[4] do	$107	$798	--	Belgium-Luxembourg $581; West Germany $217.
Metal including alloys, unwrought and partly wrought do	$40	$374	--	West Germany $278; Netherlands $95; Austria $1.
Tungsten: Metal including alloys, all forms	--	1	--	All to Yugoslavia.
Zinc:				
Oxides	--	60	--	West Germany 20; Greece 20; Italy 20.
Metal including alloys:				
Unwrought	23,591	22,523	--	Czechoslovakia 14,000; Hungary 4,371; Yugoslavia 3,537.
Semimanufactures	341	188	--	All to Yugoslavia.
Other:				
Ores and concentrates	--	21	--	All to Thailand.
Oxides and hydroxides	--	5	--	All to Spain.
Ashes and residues	28	15	--	United Kingdom 14; Italy 1.
Base metals including alloys, all forms	35	1	--	All to Yugoslavia.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Artificial: Corundum	18	25	--	All to Belgium-Luxembourg.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$56	$91	--	Do.
Grinding and polishing wheels and stones	--	6	--	Pakistan 4; Spain 2.
Boron materials:				
Crude natural borates	29	--		
Oxides and acids	165	--		
Cement[5]	52,300	67,000	--	Yugoslavia 8,500; unspecified 58,500.
Clays, crude:				
Kaolin	16,748	32,922	--	Poland 18,275; Hungary 6,103; Yugoslavia 4,237.
Unspecified	4,126	494	--	Tunisia 400; Yugoslavia 49; Austria 44.
Diamond:				
Gem, not set or strung value, thousands	$6	$20	$20	
Industrial stones do.	$876	$1,347	--	All to Belgium-Luxembourg.
Diatomite and other infusorial earth	--	151	--	All to Greece.
Fertilizer materials: Manufactured:				
Ammonia	--	11,268	--	Cyprus 6,001; Yugoslavia 5,267.
Nitrogenous[5] thousand tons	942	853	27	India 155; Greece 56; unspecified 519.
Potassic	--	2,290	1,600	Greece 690.
Unspecified and mixed	256	2,467	--	All to Austria.
Lime	731	285	--	All to Yugoslavia.
Nitrates, crude[5]	2,139	3,037	--	Czechoslovakia 1,673; Italy 191.
Pigments, mineral: Iron oxides and hydroxides, processed	101	--		
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$20	$13	--	Netherlands $11; Italy $2.
Synthetic do.	$393	$610	--	West Germany $566; Japan $44.
Sodium compounds, n.e.s.: Carbonate, manufactured[5] thousand tons	696	720	--	U.S.S.R. 473; Hungary 102; Czechoslovakia 33.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	8,143	18,981	--	Hungary 8,670; Poland 7,601; Italy 1,853.
Worked	3,166	3,635	--	West Germany 3,092; Netherlands 381; Belgium-Luxembourg 160.
Gravel and crushed rock	--	3	--	All to Italy.
Quartz and quartzite	--	1	--	All to Austria.
Sand other than metal-bearing	16,231	18,474	--	Greece 18,474; France 1.
Talc, steatite, soapstone, pyrophyllite	10	--		
Other:				
Crude	60	15,076	--	Hungary 14,616; West Germany 420; Italy 40.
Slag and dross, not metal-bearing	--	20	--	All to Norway.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1	442	--	West Germany 424; Austria 18.
Carbon: Carbon black	58	37	--	All to Italy.
Coal: Anthracite bituminous	[3]529,000	[3]306,000	--	United Kingdom 107,629; Morocco 18,316; unspecified 174,609.
Coke and semicoke	234	--		
Petroleum refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	667	529	--	Yugoslavia 434; Italy 90; Austria 5.
Gasoline do.	1,120	3,185	--	France 1,022; Spain 928; Netherlands 493.
Mineral jelly and wax do.	15	14	--	Italy 12; Netherlands 1.
Kerosene and jet fuel do.	46	723	691	Hungary 21; West Germany 11.
Distillate fuel oil do.	3,432	3,344	--	Spain 849; West Germany 790; France 431.
Lubricants do.	64	446	340	Yugoslavia 86; Austria 15.
Residual fuel oil do.	132	154	--	All to Spain.
Bitumen and other residues do.	--	7	--	Austria 6; West Germany 1.
Petroleum coke do.	24	--		
Unspecified do.	29	--		

[p]Preliminary. NA Not available.

[1]Table prepared by Jozef Plachy. 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 trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries.

[2]Less than 1/2 unit.

[3]Statistical Yearbook of Members of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

[4]May include other precious metals.

[5]Official Trade Statistics of Bulgaria.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	--	1	--	All from Switzerland.
Oxides and hydroxides	97	135	--	West Germany 98; France 19; Japan 14.
Metal including alloys:				
Scrap	6	--		
Unwrought	19,551	14,794	--	Yugoslavia 9,981; Hungary 4,455; Austria 260.
Semimanufactures	6,884	5,519	--	Hungary 2,498; West Germany 1,299; Austria 821.
Antimony:				
Oxides	16	13	--	All from West Germany.
Metal including alloys, all forms	20	--		
Beryllium: Oxides and hydroxides	20	--		
Chromium:				
Ore and concentrate	5,060	488	--	Finland 250; West Germany 238.
Oxides and hydroxides	377	330	--	U.S.S.R. 322; France 8.
Metal including alloys, all forms	6	3	--	All from United Kingdom.
Cobalt: Metal including alloys, all forms	4	2	--	France 1; West Germany 1.
Copper:				
Matte and speiss including cement copper	933	--		
Oxides and hydroxides	--	3	--	All from West Germany.
Sulfate[2]	7,967	7,087	--	All from U.S.S.R.
Metal including alloys:				
Scrap	1,197	--		
Unwrought	67	--		
Semimanufactures	1,848	2,017	--	West Germany 1,275; Austria 319; Belgium-Luxembourg 139.
Gold: Metal including alloys, unwrought and partly wrought value, thousands	$609	$624	--	West Germany $600; Belgium-Luxembourg $18; Switzerland $5.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite[2] thousand tons	2,215	2,248	--	All from U.S.S.R.
Metal:				
Scrap	--	35	--	All from Yugoslavia.
Pig iron, cast iron, related materials[2]	404,296	425,398	--	U.S.S.R. 378,065; Pakistan 7,350.
Ferroalloys:				
Ferrochromium	--	3	--	All from France.
Ferromanganese	3,000	2,640	--	France 1,283; West Germany 907; Belgium-Luxembourg 350.
Ferrosilicon	--	50	--	All from France.
Silicon metal	1,748	2,019	--	All from Yugoslavia.
Unspecified	25,000	24,000	--	NA.
Steel, primary forms thousand tons	392	257	--	Czechoslovakia 135; unspecified 120.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	374	362	--	Hungary 68; Poland 29; unspecified 190.
Universals, plates, sheets[2] do	139	131	--	U.S.S.R. 73; Poland 9; West Germany 4.
Hoop and strip[2] do	3	3	--	U.S.S.R. 2.
Rails and accessories do	66	64	--	NA.
Wire do	14	12	--	Austria 3; West Germany 1; unspecified 6.
Tubes, pipes, fittings do	73	188	(3)	Spain 21; Yugoslavia 8; unspecified 145.
Castings and forgings, rough do	9	8	--	NA.
Lead:				
Ore and concentrate	82,694	6,034	--	Italy 4,000; Morocco 1,650; Yugoslavia 384.
Oxides	1	--		
Metal including alloys:				
Unwrought	200	19	--	All from Canada.
Semimanufactures	--	5	5	
Lithium: Oxides and hydroxides	--	3	--	All from West Germany.
Magnesium: Metal including alloys:				
Unwrought	30	--		
Semimanufactures	38	44	--	Do.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Manganese:				
Ore and concentrate, metallurgical-grade	[4]92,600	[4]82,500	--	U.S.S.R. 63,000.
Oxides	--	582	--	Greece 570; Japan 12.
Mercury 76-pound flasks	--	29	--	All from Switzerland.
Molybdenum: Metal including alloys, all forms	3	3	1	Netherlands 2.
Nickel: Metal including alloys, semimanufactures	421	130	--	West Germany 69; Austria 34; France 18.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$4,320	$4,963	--	France $2,470; West Germany $2,402; Switzerland $47.
Silver: Metal including alloys, unwrought and partly wrought do.	$1,039	$717	--	West Germany $607; Austria $90; Switzerland $17.
Tin:				
Oxides	10	--		
Metal including alloys:				
Unwrought	140	2	--	All from Netherlands.
Semimanufactures	--	2	--	France 1; United Kingdom 1.
Titanium:				
Ore and concentrate	2,319	2,638	--	Netherlands 2,240; West Germany 398.
Oxides	1,508	1,018	--	West Germany 452; Belgium-Luxembourg 200; France 200.
Metal including alloys, all forms	--	15	--	All from Japan.
Tungsten: Metal including alloys, all forms	8	22	NA	France 14; Netherlands 4; Japan 2.
Zinc:				
Ore and concentrate	16,950	10,425	--	Canada 10,111; Yugoslavia 314.
Metal including alloys, semimanufactures	4	2	--	France 1; West Germany 1.
Zirconium: Ore and concentrate	1,673	1,040	--	Netherlands 547; West Germany 466.
Other:				
Ores and concentrates	1	--		
Oxides and hydroxides	91	1	--	All from West Germany.
Ashes and residues	2	--		
Base metals including alloys, all forms	147	10	--	Austria 5; West Germany 3; France 1.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	1	2	--	All from West Germany.
Artificial:				
Corundum	2,684	2,997	--	Yugoslavia 1,544; Italy 1,167; Hungary 261.
Silicon carbide	660	244	--	All from Italy.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$269	$292	--	United Kingdom $232; Japan $59; West Germany $1.
Grinding and polishing wheels and stones	1,472	1,040	([3])	Austria 403; Italy 267; Yugoslavia 234.
Asbestos, crude	3,132	1,979	--	Greece 1,420; Canada 559.
Boron materials: Crude natural borates	8,000	--		
Cement[2]	71,006	36,856	--	U.S.S.R. 30,982; Czechoslovakia 3,508; France 581.
Chalk	20	40	--	United Kingdom 21; France 19.
Clays, crude:				
Fire clay	21	373	--	All from Yugoslavia.
Kaolin	3,497	3,956	--	United Kingdom 3,954; West Germany 2.
Unspecified	100	953	80	West Germany 873.
Diamond:				
Gem, not set or strung value, thousands	--	$121	--	All from United Kingdom.
Industrial stones do.	$6,250	$4,463	--	Belgium-Luxembourg $3,367; United Kingdom $1,096.
Diatomite and other infusorial earth	1,356	1,102	--	Austria 765; Iceland 335; Switzerland 2.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Feldspar, fluospar, related materials:				
Feldspar	--	245	--	All from Yugoslavia.
Fluorspar	850	207	--	All from West Germany.
Unspecified	312	--	--	
Fertilizer materials: Manufactured:				
Ammonia	4	--		
Nitrogenous	24	17	--	France 16; West Germany 1.
Phosphatic ----- thousand tons	[4]1,344	[4]889	--	U.S.S.R. 207; Tunisia 28; unspecified 645.
Potassic ----------do----	[4]214	[4]216	--	U.S.S.R. 189.
Unspecified and mixed ----do----	12	([3])	--	Mainly from United Kingdom.
Graphite, natural	2,045	1,421	--	Austria 873; West Germany 548.
Gypsum and plaster	103	4	--	West Germany 3; Italy 1.
Lime	70	511	--	Yugoslavia 461; Finland 50.
Magnesium compounds	25,629	6,623	--	Czechoslovakia 6,000; France 227; Austria 201.
Mica: Worked including agglomerated splittings	36	45	--	Austria 33; West Germany 8; Switzerland 4.
Phosphates, crude[2] --- thousand tons	1,566	1,310	--	U.S.S.R. 803; Morocco 68; Tunisia 44.
Pigments, mineral:				
Natural crude	--	2	--	All from West Germany.
Iron oxides and hydroxides, processed	866	505	18	Japan 486; France 1.
Precious and semiprecious stones other than diamond:				
Natural --- value, thousands	$33	--		
Synthetic ----------do----	$44	$62	--	West Germany $49; Switzerland $13.
Pyrite, unroasted	238,047	210,000	--	All from U.S.S.R.
Salt and brine	10	3,737	--	All from West Germany.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	2,275	726	--	All from Poland.
Sulfate, manufactured	1,000	16	--	All from Japan.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	154	353	--	Greece 342; Italy 11.
Worked	48	83	--	Italy 82; West Germany 1.
Gravel and crushed rock	1,090	13,333	--	United Kingdom 12,053; Yugoslavia 1,276; West Germany 4.
Quartz and quartzite	1,827	1,646	--	Sweden 1,258; West Germany 388.
Sand other than metal-bearing	1,431	800	--	Yugoslavia 672; West Germany 63; Hungary 20.
Sulfur:				
Elemental: Crude including native and byproduct	50,010	60,000	--	All from Poland.
Sulfuric acid	8,694	19,181	--	Hungary 19,092; West Germany 89.
Talc, steatite, soapstone, pyrophyllite	245	307	--	Spain 184; Italy 82; Finland 40.
Vermiculite, perlite, chlorite	--	170	--	All from Greece.
Other: Crude	2,034	800	--	Greece 605; West Germany 130; Netherlands 65.
MINERAL FUELS AND RELATED MATERIALS				
Carbon: Carbon black[2]	37,931	34,086	--	U.S.S.R 27,634; Italy 2,224; Romania 2,100.
Coal:				
Anthracite and bituminous[2] thousand tons	5,528	7,304	29	U.S.S.R. 5,229; Netherlands 36.
Briquets of anthracite and bituminous coal----------do----	([3])	--		
Lignite including briquets --do----	--	1	--	All from Yugoslavia.
Coke and semicoke[2]	664	471	102	Japan 120; U.S.S.R. 52.
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	--	58	--	All from France.
Gasoline ----------do----	281,699	23,741	--	Yugoslavia 23,520; Netherlands 170; West Germany 51.
Mineral jelly and wax -----do----	322	4,903	--	West Germany 4,596; Austria 165; Yugoslavia 118.
Kerosene and jet fuel -----do----	387	1,163	--	Yugoslavia 457; Belgium-Luxembourg 240; West Germany 186.
Distillate fuel oil --------do----	343	358	--	West Germany 351; Switzerland 7.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum refinery products —Continued				
Lubricants 42-gallon barrels	78,939	49,245	--	Austria 13,867; West Germany 10,801; United Kingdom 7,791.
Residual fuel oil do	480,153	1,779,632	310,756	Greece 1,323,375; Spain 145,421.
Bitumen and other residues do	32,515	22,506	--	Hungary 21,137; West Germany 1,151; France 218.
Bituminous mixtures do	54	109	--	Austria 91; France 12; West Germany 6.
Petroleum coke do	2,382	1,133	--	All from West Germany.

[p]Preliminary. NA Not available.

[1]Table prepared by Jozef Plachy. 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 trade. Unless otherwise specified, these data have been complied from United Nations information and data published by the trading partner countries.

[2]Official Trade Statistics of Bulgaria.

[3]Less than 1/2 unit.

[4]Statistical Yearbook of Members of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

COMMODITY REVIEW

METALS

Copper.—The development of the Asarel copper mining and beneficiation complex remained the major event in Bulgaria's copper industry. Completion of one-third of the complex's capacity was to have been met by 1988, and full operation was to have been achieved by 1989. However, owing to delays in the delivery of construction materials and equipment, operational startup would not begin until 1989. Ore output from the Asarel open pit would take up the slack from the declining production of the Medet open pit copper mining and beneficiation complex. The ore from the Asarel would be smelted at the Georgi Damyanov copper smelting complex at Pirdop in Sredniegorie.

Iron and Steel.—Early in 1987, Bulgaria announced that as many as five electric arc furnaces would be installed at the new Burgas iron and steel works within 5 years. Also, a direct-reduction plant may be installed at the Burgas facility as well. The Burgas iron and steel works was fueled by domestic natural gas, as well as by natural gas transported by pipeline from the U.S.S.R. Facility expansion at Burgas in 1987 included the construction of a 800,000-ton-per-year light section mill supplied by the Schwermaschinenbaukombinat Ernst Thalmann (Sket Corp.) of the German Democratic Republic.

The new mill was to have been completed by early 1988. Billets used to feed the new mill would be provided by the Leonid Brezhnev steelworks at Kremikovtsi, and the Lenin steelworks at Pernik. The mill would significantly reduce Bulgaria's import reliance on long steel products. A cooperative venture was sought with the Soviet Union to increase Bulgaria's production of steel bars, which would also significantly reduce the country's import reliance on this product. Voest-Alpine AG of Austria was chosen to conduct studies and make plans to modernize the Leonid Brezhnev steelworks by the addition of continuous casting and automation and modernization of the entire downstream production process. Bulgaria disclosed plans for a 34-fold increase in continuous casting capacity by 1990. Over the same period, Bulgaria planned to increase its output of special steels and to reduce its import reliance 10% to 15%. Late in the year, Greece's Ministry of Industry began an investigation of alleged steel dumping violations by Bulgaria and Yugoslavia.

INDUSTRIAL MINERALS

Barite, bentonite, dolomite, fluorite, gypsum, kaolin, marble, and perlite continued to be the main industrial minerals that Bulgaria produced. In aggregate, between 3.6 and 4 million tons was produced on an annual basis.

MINERAL FUELS

Coal.—Bulgaria continued to produce sufficient amounts of low-grade lignite but

only negligible amounts of bituminous coal. Most of the country's needs for hard coal was met by imports from the Soviet Union. The construction of a new lignite mine was reported near Aheloi. Production startup was planned for 1989, and initial output would be 50,000 tons per year. By 1990, production would double; mining operations would last for 20 years.

Natural Gas and Petroleum.—Bulgaria continued to participate in the construction of the Progress natural gas main pipeline, which would extend from the Yamburg in the U.S.S.R. to the western border of that country. Bulgaria's participation in this project would assure adequate supplies and discounts on future Soviet deliveries of natural gas to Bulgaria. Bulgaria would also be a conduit of Soviet natural gas to Greece and Turkey, thereby benefiting by transit fees as well.

Nuclear Power.—Bulgaria reported the startup of the fifth reactor rated at 1,000 megawatts at the Kozloduy nuclear powerplant. The four older reactor blocks were rated at 440 megawatts each. At the same time, it was announced that the construction of a new nuclear powerplant was begun at Belene in the Lovech region. Nuclear energy accounted for approximately 30% of the country's total power output.

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[1]Foreign mineral specialist, Division of International Minerals.

[2]Rabotnichesko Delo. Jan. 27, 1988, pp. 1-3.

The Mineral Industry of Burma

By Gordon L. Kinney[1]

Burma produced at least 30 minerals in commercial amounts during 1987. The most important nonfuel minerals were barite, cement, copper, gem stones, gypsum, lead, silver, steel ingot, tin, tungsten, and zinc. Burma attained world-class production in two minerals. It was 6th in tungsten and 10th in tin output during 1987. Of the minerals, fuels were most important to the Burmese economy. In value, crude oil production was by far the most important mineral, followed by natural gas. An insignificant amount of poor-grade anthracite coal was mined.

A gradual decline in crude production, combined with a steady increase in demand, has caused a serious shortage of fuel, which hindered the fulfillment of economic development plans. State-owned corporations were unable to meet gasoline and diesel requirements; consequently, implementation of many foreign-financed projects was delayed. The transportation sector was affected particularly, and the resultant higher transportation costs contributed to Burma's worsening inflation.[2] Vehicle fuel was rationed and difficult to obtain in outlying areas, even with ration coupons. Fuel prices on the black market were reportedly 15 to 30 times the official Government price. The oil shortage directly affected production of lead, silver, and zinc and hindered the efficiency of other mineral producers as well.

Burma's economic and financial difficulties intensified in fiscal year (FY) 1986[3] and apparently did not improve in early FY 1987. (Complete figures for FY 1987 were not available.) Although the Government reported a growth rate of 3.7% for FY 1986, lower imports of essential industrial raw materials, equipment, and spare parts, and a resultant decline in the output of many industrial products, suggested that the growth rate was considerably lower. Even the 3.7% growth rate figure represented an official acknowledgment that the growth rate declined for the second year in a row, from 5.9% in FY 1984 and 4.3% in FY 1985.

Falling export earnings have forced the Government to draw down foreign reserves, which fell to a record low of $24 million in February 1987.[4] The reduced reserves meant that most export earnings were needed for debt repayment; imports were therefore cut to a minimum. These cutbacks were not reflected in the import statistics, which included equipment and supplies for continuing projects and commodity imports financed by foreign donors. They have, however, had a serious impact on the regular import budgets of Burma's state-owned corporations. Decreased budgets for imported industrial raw materials, components, and spare parts resulted in declining production of many products.

The declining industrial output and higher transportation costs have led to a sharply higher inflation rate. The consumer price index for Rangoon, which rose 5% to 7% annually in recent years, increased to more than 26% in FY 1986.

The mining sector employed 90,000 workers in 1987, which was 0.6% of the active labor force. Of these, 77,000 were employed by Government-owned mining companies. Mining accounted for 1.8% of the country's net output of goods and services. Public investment in the mining sector totaled $34 million in FY 1986.

PRODUCTION

During FY 1986, the mining sector produced 87% of the Government's target and the net value of that output increased 19%, according to the annual Government report to the legislature.[5] The value of nonfuel mining output at current prices was $159 million in FY 1986. The previous year's figures were revised sharply downward in the same source.[6] Crude oil value in 1987 was estimated at $140 million to $170 million, and natural gas value was estimated at over $80 million. The 9-month figures available for 1987 showed a strong downward trend for major metallic minerals, cement, and nitrogenous fertilizer.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987[p]
METALS					
Copper:					
Mine output, Cu content	4,200	12,000	16,700	11,368	17,312
Matte, gross weight	173	173	173	144	234
Iron and steel: Pig iron	15,200	7,764	--	--	--
Lead:					
Mine output, Pb content	23,146	21,937	21,935	18,156	27,132
Metal:					
Refined	7,636	6,996	9,585	5,359	3,985
Antimonial lead (18% to 20% Sb)	313	254	e300	299	305
Nickel:					
Mine output, Ni content[e]	20	20	20	20	20
Speiss, gross weight	80	80	80	86	e80
Silver, mine output thousand troy ounces	558	455	568	527	839
Tin, mine output, Sn content:					
Of tin concentrate	629	745	622	600	256
Of tin-tungsten concentrate	1,013	1,283	1,129	895	683
Total	1,642	2,028	1,751	1,495	939
Tungsten, mine output, W content:					
Of tungsten concentrate	235	216	171	102	25
Of tin-tungsten concentrate	695	880	774	613	468
Total	930	1,096	945	715	493
Zinc, mine output, Zn content	4,537	5,320	4,353	4,643	2,561
INDUSTRIAL MINERALS					
Barite[3]	9,989	9,967	8,100	8,149	17,273
Cement, hydraulic	334,685	311,179	477,000	433,811	389,605
Clays:[3]					
Ball clay	404	960	110	496	203
Bentonite	710	725	710	851	406
Fire clay[4]	e1,780	1,220	1,370	2,040	1,422
Industrial white clay	810	357	610	203	610
Feldspar[3]	e2,700	6,220	2,446	2,861	1,916
Graphite[3]	200	234	234	722	--
Gypsum[3]	34,278	27,580	38,594	38,889	23,135
Nitrogen: N content of ammonia[5]	53,900	56,916	125,795	133,130	117,501
Precious and semiprecious stones: Jadeite[3] kilograms	45,700	90,990	43,145	12,804	13,529
Salt[6] thousand tons	288	280	320	321	341
Stone:[3]					
Dolomite	4,400	1,305	2,383	5,253	5,952
Limestone, crushed and broken thousand tons	1,247	1,210	1,541	1,329	1,411
Talc and related materials: Soapstone[3]	128	91	128	56	22

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987[p]
MINERAL FUELS AND RELATED MATERIALS					
Coal, lignite	34,500	44,232	43,000	43,848	45,700
Gas, natural:					
Gross[e] million cubic feet	20,000	26,000	34,000	40,000	[7]42,000
Marketed[3] do	18,190	24,417	32,962	38,290	[e]40,000
Petroleum:					
Crude (gross wellhead)[3] thousand 42-gallon barrels	10,168	11,200	10,253	10,103	6,351
Refinery products[e] do	7,000	8,000	8,000	7,500	5,800

[e]Estimated. [p]Preliminary.

[1]Table includes data available through June 14, 1988.

[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 year beginning Apr. 1 of that stated.

[4]Includes fire clay powder.

[5]Computed at 46% of reported fertilizer production.

[6]Brine salt production as reported by the Burmese Government was as follows: 1983—200,944; 1984—81,166; 1985—44,508; 1986—52,084; and 1987—63,765.

[7]Reported figure.

TRADE

Exports of minerals and gem stones accounted for $31 million or 7.8% of commodity exports in FY 1985, the latest available figures. Provisional figures for FY 1986 increased to $39 million. The sales at the 23d Annual Gem Emporium declined from the 1985 record high of $9.3 million to $7.5 million in 1986. Dealer attendance at the 1986 sale was much lower because it was conducted in November instead of in the traditional month of February. Many dealers were unable to attend because they were preparing for the peak holiday sales season. Burmese officials may return the sale to February in light of the poor November results.

In FY 1986, Burma did not appear to achieve a significant improvement in export earnings, which began to decline in FY 1984. Provisional government statistics for FY 1986 showed exports of $407 million, but other sources estimated them to be about $330 million.[7] Because of declining prices, the value of Burma's major exports has declined 26% since 1981. Tin and tungsten prices declined 54% and 18%, respectively, during this period. Burma has been unable to diversify exports to any significant degree. Recently, seven commodities—beans, gem stones and jade, marine products, metallic ores, rice, rubber, and teak—accounted for 95% of export earnings. The effort to expand export items met with some success in such mineral commodities as liquefied petroleum gas (LPG), methanol, and urea. Although small at this time, they could increase significantly in the future.

COMMODITY REVIEW

METALS

Iron and Steel.—Production of steel grinding balls and truncated grinding cones began in 1987 at the No. 1 iron and steel plant at Anisakan. The initial output was to be 3,000 tons of 50-millimeter and 70-millimeter balls and cones for domestic mining needs. This grinding medium was formerly imported at considerable expenditure of foreign exchange.

The Ywama steelworks modernization was mostly completed by yearend FY 1986 when test runs of the new equipment were begun. According to a Government report,[8] expanded production of barbed wire, bars, nails, and sheets was to begin in FY 1987.

Lead and Zinc.—Expansion of No. 1 Mining Corp.'s ore concentration plant at the Bawdwin Mine complex from a capacity of 500 to 1,000 tons per day was reportedly completed in late FY 1986. Financial aid was provided by the Federal Republic of Germany. Test runs began at the plant in 1987. Copper matte, lead, nickel speiss, silver, and zinc concentrate produced by the complex have been exported for many years.

MINERAL FUELS

Natural Gas.—To alleviate the problems caused by declining oil production, the Government has been developing its gasfields as fast as financing and technology allow. Natural gas production has more than doubled since 1983. Gas is being substituted for fuel oil at new and existing factories and as feedstock for fertilizer and petrochemical plants. The main development during 1987 was Government-owned Myanma Oil Corp.'s (MOC) expansion of the Payagon Gasfield, 50 kilometers southwest of Rangoon. The International Development Association was supplying $63 million in credit toward the $200 million cost. Twelve new production wells and seven appraisal wells are to increase gas output by 35 million cubic feet per day. The project was to include a 40-centimeter pipeline to Rangoon, a basic gas distribution network to serve the capital, and pilot LPG and compressed natural gas plants. The field currently supplies 12 million cubic feet per day through a small pipeline to four industrial plants and three powerplants in the Rangoon area. A planned second phase would extend the pipeline to industries in Mon and Karen States east of Rangoon.[9]

Gas use will be further expanded by a Government plan to set up a 60-megawatt gas turbine power station at Thaketa, a suburb of Rangoon. The project is to be financed by a loan from Japan's Overseas Economic Cooperation Fund.

In addition to the LPG plant mentioned above, Petro-Chemical Industries Corp. completed an LPG plant that was begun in FY 1982. Production of 300,000 barrels per year of LPG was scheduled to begin in 1987.

Petroleum.—Declining energy supplies and spare parts shortages combined to hinder virtually all sectors of the Burmese economy except for the military. Burmese officials stated that energy production fell 20% in 1986. Overdrawing of wells was believed to be causing as much as a 30% infusion of water and mud into the wells' output. Another indication of the extent of the crude oil shortage was Burma's refinery utilization rate, which fell below 30% in FY 1986, the latest figure available. The main causes of the oil production decline were aging of the country's producing oilfields, shortages of spare parts and replacement equipment, and a lack of technology to develop the more complicated new oilfields or utilize secondary recovery methods at existing fields. In addition, a severe foreign-exchange shortage exacerbated the problem by making it unlikely for Burma to raise sufficient capital for equipment and technology to upgrade the fields. Much of the recent oilfield development has been done with foreign funding, mostly Japanese.

Several U.S. and other foreign oil companies held discussions with Ministry of Energy officials about participating in the exploration of Burma's onshore crude oil resources. Although discussions were apparently welcomed and several proposals submitted, no contracts were signed. The energy ministry, however, apparently remained interested in discussing foreign cooperation in exploring its offshore resources.

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[1]Physical scientist, Division of International Minerals.
[2]U.S. Embassy, Rangoon, Burma. State Dep. Airgram A-009, July 2, 1987, p. 8.
[3]The Burmese fiscal year begins Apr. 1 of the year stated.
[4]Where necessary, values have been converted from Burmese kyats (K) to U.S. dollars at the rate of K6.74=US$1.00.
[5]Ministry of Planning and Finance. Report to the Pyithu Hluttaw on the Economic and Social Condition of the Socialist Republic of the Union of Burma for 1987-88. P. 117.
[6]Page 24 of work cited in footnote 5.
[7]Page 4 of work cited in footnote 2.
[8]Page 259 of work cited in footnote 5.
[9]Petroleum News. V. 18, No. 7, Oct. 1987, p. 7.

The Mineral Industry of Canada[1]

By Harold R. Newman[2]

Continuing efforts by the Canadian mineral industry to increase efficiency and productivity, combined with rising commodity prices, resulted in improved performance. Production, revenues, profits, and investment in most resource-based industries rose substantially. High rates of capacity usage and increased potential for export sales encouraged some sectors to expand capacity; however, most capital expenditures were directed toward modernization and improved productivity. Major capital expenditures on plant modernization were expected to sustain significant growth in spending on machinery and equipment. Canada continued to achieve strong economic growth with an estimated growth of 3.6% for the year. Although full-time employment rose more than 3% in 1987, employment levels in the minerals industry were relatively unchanged. Employment in mining, including coal, and mineral manufacturing was reported to be about 380,000.

Government Policies and Programs.—The Federal-Provincial Mineral Development Agreements (MDA) with Newfoundland, Nova Scotia, New Brunswick, Manitoba, Saskatchewan, Prince Edward Island, and the Yukon were to be completed in 1989. The MDA with British Columbia, Ontario, and Quebec were to finish in 1990. Work was continuing in all areas designated for geoscientific investigations. In early 1987, the Canada-Northwest Territories Agreement was extended to 1991 and included an MDA. The MDA provides $4.3 million[3] for geoscience, $755,000 for a Northern Technology Assistance Program, and $227,000 for a Northern Miner Information Program. The National Transportation Act of 1987 and the Motor Vehicle Transport Act of 1987 became effective January 1, 1988. These acts essentially would deregulate transportation and were expected to reduce shipping costs for the mineral industry. Although tolls remained frozen on the Montreal-Lake Ontario section of the St. Lawrence Seaway in 1987, they were raised by 40% on the Canadian Welland Canal section. Cargo traffic increased in 1987. Iron ore shipments almost 19% on the Montreal-Lake Ontario section and almost 5% on the Welland Canal.

The United States and Canada concluded an historic, comprehensive trade agreement on October 4, 1987. If approved by the legislatures of both countries, the Free Trade Agreement (FTA) would go into effect January 1, 1989. It was intended to remove barriers to trade and investment between the two countries for most industrial, agriculture, and service sectors.

Flow-through share funding continued to attract capital for mineral exploration. It offered a sizable tax incentive. Investors who put their money into flow-through shares were allowed to write off 100% of their investments as well as an additional 33% earned-depletion allowance. Therefore, the investor could deduct 133% of the investment from taxable income earned from other sources. Flow-through shares were used by mineral resource companies that did not have enough taxable income to write off exploration expenses. It was reported that more than $1.5 billion had been raised for exploration via flow-through shares over the past 5 years.

According to the Canadian Department of Energy, Mines and Resources (EMR), the total value and volume of Canadian mineral production increased in 1987 compared with those of 1986. Value of output, including metals, industrial minerals, mineral fuels, and related materials was $27.2 billion in 1987 compared with $24.2 billion (revised) in 1986. The mineral fuel and related materials sector, not including uranium, accounted for more than $15 billion of the overall value of mineral output. The metals sector accounted for almost $8 billion output, and the industrial minerals sector accounted for the remainder. The 10 leading minerals, based on value of output, were petroleum, natural gas, gold, natural gas byproducts, copper, zinc, coal, nickel, iron ore, and uranium. Production values of the Provinces and Territories were as follows, in billion dollars:

Province or Territory	1986	1987[p]
Alberta	12.3	12.9
Ontario	3.6	4.2
British Columbia	2.4	2.6
Saskatchewan	1.9	2.3
Quebec	1.7	1.9
Manitoba	.6	.7
Northwest Territories	.3	.6
Newfoundland	.6	.6
New Brunswick	.3	.5
Yukon	.1	.3
Nova Scotia	.2	.3
Prince Edward Island	(1)	(1)
Total[2]	24.2	27.2

[p]Preliminary.
[1]Less than 1/2 unit.
[2]Data may not add to totals shown because of independent rounding.

Source: Department of Energy, Mines and Resources, Ottawa, Canada, 1987.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Alumina, gross weight thousand tons	1,116	1,126	1,019	[e]1,100	953
Metal:					
Primary	1,091,231	1,227,000	1,282,316	[e]1,364,000	1,530,000
Secondary	63,000	64,000	65,000	[e]68,000	69,000
Antimony[e 2]	--	554	1,075	[e]3,805	3,575
Bismuth[3]	202	166	201	153	178
Cadmium[4]	1,456	1,605	1,717	1,484	2,294
Calcium kilograms	W	W	W	W	W
Cobalt:					
Mine output, Co content[5]	1,584	2,325	2,067	2,486	2,877
Metal[6]	1,324	2,213	2,023	1,990	--
Columbium and tantalum:					
Cb concentrate (pyrochlore):					
Gross weight	3,039	4,400	4,944	5,216	4,304
Cb content	1,256	1,987	2,223	2,340	1,937
Copper:					
Mine output, recoverable Cu content[7]	653,040	721,826	738,637	698,527	767,299
Metal, primary and secondary:					
Blister and anode	[r]409,700	[r]470,600	489,700	472,700	[e]474,000
Refined	464,333	504,252	499,626	493,445	491,180
Gold thousand troy ounces	2,363	2,683	2,815	3,308	3,788
Iron and steel:					
Iron ore:[8]					
Gross weight thousand tons	33,495	[r]39,930	39,502	36,167	37,553
Fe content do	21,300	[r]25,156	24,847	22,785	23,658
Metal:					
Pig iron do	8,567	9,643	9,665	9,249	9,500
Ferroalloys do	269	216	227	[e]240	260
Steel, crude do	12,828	14,715	14,600	14,100	14,700
Lead:					
Mine output, Pb content	251,467	264,301	284,600	349,281	413,449
Metal, refined:					
Primary	178,043	173,000	173,220	169,934	139,479
Secondary	63,914	79,000	68,384	87,746	86,296
Lithium: Spodumene[9]	--	82	[e]301	624	650
Magnesium metal, primary[e]	6,000	8,000	7,000	7,000	7,000
Molybdenum	10,194	11,557	7,852	11,251	11,580
Nickel:					
Mine output, Ni content[10]	128,113	173,725	169,971	163,639	194,507
Metal, plant production[11]	[r]95,811	[r]121,425	119,129	123,730	--
Platinum-group metals troy ounces	223,925	333,363	338,676	391,917	433,681
Selenium, refined[12] kilograms	266,000	463,000	361,000	354,000	496,000
Silver thousand troy ounces	35,559	42,655	38,484	34,979	40,180

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS —Continued					
Tellurium, refined[13] ____ kilograms	[e]16,000	21,000	19,000	20,000	27,000
Tin, mine output, Sn content	141	217	120	2,450	3,390
Titanium:					
Ilmenite, gross weight ____ thousand tons	1,865	1,800	2,560	2,500	2,600
Sorel slag (80% TiO_2)[13]	630,000	733,000	850,000	840,000	900,000
Uranium oxide (U_3O_8)	8,483	12,113	12,312	13,564	15,560
Zinc:					
Mine output, Zn content	1,069,709	1,207,098	1,172,200	1,290,765	1,500,232
Metal, refined, primary	617,033	683,156	692,418	570,981	610,474
INDUSTRIAL MINERALS					
Asbestos ____ thousand tons	858	837	750	662	665
Barite	45,465	[r]64,197	71,049	40,000	41,000
Cement, hydraulic[14] ____ thousand tons	7,871	[r]9,240	10,192	10,602	12,590
Clays and clay products[15] ____ value, thousands	$127,400	$100,200	$138,246	$180,353	$210,000
Diatomite[e]	2,000	4,000	3,800	4,100	4,200
Gypsum and anhydrite ____ thousand tons	7,507	7,756	8,447	8,803	8,811
Lime ____ do.	2,232	2,266	2,212	2,243	2,280
Magnesite, dolomite, brucite	67,000	69,000	136,000	144,000	150,000
Mica, scrap and flake	10,433	10,881	11,500	12,000	13,500
Nepheline syenite	528,000	521,000	467,000	469,000	500,000
Nitrogen: N content of ammonia	2,887,870	3,493,464	3,620,286	[e]3,540,000	3,600,000
Potash, K_2O equivalent ____ thousand tons	[r]6,294	7,527	6,661	6,752	7,465
Pyrite and pyrrhotite, gross weight[e]	5,000	5,000	6,000	6,000	5,000
Salt ____ thousand tons	8,602	10,235	10,085	10,332	9,990
Sand and gravel ____ do.	233,408	233,759	256,183	257,971	260,300
Silica (quartz)	2,303	2,624	2,669	2,640	2,560
Sodium compounds, n.e.s.:					
Sodium carbonate[e]	425,000	365,000	350,000	350,000	325,000
Sodium sulfate, natural[16]	454,000	[r]389,000	366,000	371,000	340,000
Stone[17] ____ thousand tons	74,466	81,754	86,632	97,602	105,675
Sulfur:					
Elemental byproduct:					
Of smelter gases ____ do.	678	875	822	758	803
Of sour natural gas ____ do.	5,390	5,260	5,306	6,966	5,249
Of refineries[e] ____ do.	170	165	[r]174	[r]189	190
Of tar sands ____ do.	330	296	392	435	426
S content of pyrite and pyrrhotite[e] ____ do.	9	(18)	(18)	(18)	--
Talc, soapstone, pyrophyllite	97,000	126,000	127,000	123,000	141,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	[e]135,000	176,543	173,022	154,418	160,000
Coal:					
Bituminous and subbituminous	37,146,000	47,510,000	60,436,000	57,811,000	59,790,000
Lignite	7,760,000	9,918,000	9,672,329	8,281,312	8,560,000
Coke, high-temperature	4,120,000	[r]4,900,478	4,683,770	4,552,600	4,600,000
Gas, natural:					
Gross ____ million cubic feet	3,372,670	3,173,708	3,250,000	3,150,000	4,087,309
Marketed ____ do.	2,465,100	2,505,818	2,831,200	2,695,680	2,803,084
Natural gas liquids:					
Gross:					
Butane ____ thousand 42-gallon barrels	19,793	30,492	20,068	18,733	20,197
Propane ____ do.	30,211	37,322	32,656	31,288	33,545
Pentanes plus ____ do.	33,371	34,513	36,654	36,932	36,000
Ethane ____ do.	29,577	35,765	34,664	32,444	40,866
Condensate ____ do.	880	1,057	1,043	828	1,012
Total ____ do.	113,832	139,149	125,085	120,225	131,620
Peat	544,000	541,000	643,000	738,000	720,000
Petroleum:					
Crude[19] ____ thousand 42-gallon barrels	494,617	526,350	538,200	536,739	516,157
Refinery products:					
Gasoline:					
Aviation ____ do.	1,081	1,297	1,131	1,887	1,522
Other ____ do.	204,685	203,797	203,793	200,068	209,243
Jet fuel ____ do.	26,442	26,434	27,707	29,169	31,900
Kerosene ____ do.	13,809	13,831	13,573	13,962	12,945
Distillate fuel oil, diesel and light ____ do.	137,693	145,497	140,334	140,939	147,048
Residual fuel oil, heavy ____ do.	58,857	54,723	44,240	41,312	44,100
Lubricants ____ do.	4,940	5,808	5,755	5,414	6,000
Liquefied petroleum gas, propane and butane ____ do.	20,453	21,041	20,421	17,908	15,159
Petrochemical feedstocks ____ do.	26,973	27,527	27,595	32,246	29,871
Asphalt ____ do.	16,666	16,108	18,236	16,437	19,040

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Petroleum coke thousand 42-gallon barrels	27,128	30,922	41,244	30,621	32,000
Unspecified do					
Refinery losses do	10,753	12,823	24,872	35,505	31,934
Total do	549,480	559,808	568,901	565,468	580,852

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available. W Withheld to avoid disclosing company proprietary data.

[1]Table includes data available through May 1988.

[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 the 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 represent gross weight and metal content of usable iron ore (including byproduct ore) actually produced.

[9]Based on U. S. imports.

[10]Refined nickel from domestic ores plus recoverable Ni content of exported matte.

[11]Includes metallic nickel, nickel oxide, Incomet, nickel powder and pellets, utility nickel, nickel carbonate, and nickel residue.

[12]From all sources, including imports and secondary sources.

[13]Refined sorel slag contained 74% TiO_2 in 1983 and 80% TiO_2 in 1984-87.

[14]Cement shipped and/or used by producers.

[15]Includes bentonite products from common clay, fire clay, stoneware clay, and other clays.

[16]Excludes byproduct production from chemical plants.

[17]Crushed, building, ornamental, paving, and similar stone.

[18]Revised to zero.

[19]Including synthetic crude (from oil shale and/or tar sands).

Table 2.—Canada: Relative importance of mineral production in 1987, by commodity

(Percent)

Commodity	Share of total[p]
Petroleum	33.3
Natural gas	12.0
Gold	6.2
Natural gas byproducts	5.6
Copper	5.1
Zinc	4.7
Coal	4.5
Nickel	3.6
Iron ore	3.5
Uranium	3.1
Cement	2.7
Potash	2.0
Sulfur, elemental	1.8
Other	11.9
Total	100.0

[p]Preliminary.

Source: Department of Energy, Mines and Resources, Ottawa, Canada, 1987.

The Canadian minerals industry displayed improved performance in 1987 as a result of sustained productivity gains and increased prices for mineral commodities. Mining activities were conducted in every region of the country, with about 300 mines operating in 1987. Exploration expenditures in 1987 were estimated at more than $640 million. The most active exploration areas continued to be Quebec and Ontario Provinces. Almost three-quarters of exploration expenditures were in precious metals, mainly gold.

According to EMR, more than 40 projects to develop additional metal production capability were announced in 1987. These projects were expected to inject more than $528 million into the Canadian economy over the next few years, most of it in remote areas of the country. These projects reflect the high level of mineral industry activity in Canada. The values of principal mineral production were as follows in million dollars:

Commodity	1986	1987[p]
METALS		
Gold	1,275	1,693
Copper	1,076	1,393
Zinc	906	1,278
Nickel	739	973
Iron ore	1,014	945
Uranium (U)	787	846
Lead	172	312
Silver	170	282
Molybdenum	68	70
Total[1]	6,207	7,819
INDUSTRIAL MINERALS		
Cement	622	737
Sand and gravel	512	550
Potash	441	524
Sulfur, elemental	647	491
Salt	181	178
Asbestos	177	178
Clay products	136	159
Lime	129	134
Gypsum	63	66
Total[1]	2,908	3,017
MINERAL FUELS		
Petroleum	7,251	9,054
Natural gas	4,245	3,255
Natural gas, byproducts	1,361	1,523
Coal	1,303	1,234
Total[1]	14,166	15,066

[p]Preliminary.
[1]Data may not add to totals shown because of independent rounding.

Source: Department of Energy, Mines and Resources, Ottawa, Canada, 1987.

TRADE

The United States and Canada initiated negotiations toward a bilateral FTA in the fall of 1985. After 16 months of negotiations, the framework for the agreement was completed and signed by negotiators of both countries on October 4, 1987. The final form of the agreement was signed by leaders of both countries on January 2, 1988.

This agreement created the world's largest free trade area, affecting trade of about $150 billion per year. In a period of increasing protectionist pressure, the two countries agreed to a number of liberalized policies and a comprehensive trade package. The primary objective of the FTA was the elimination of all tariff and nontariff barriers. The agreement would eliminate bilateral tariffs within 10 years, beginning January 1, 1989. Products were assigned to one of three categories for purposes of eliminating duties: (1) immediate, (2) 5 years (20% cut per year), and (3) 10 years (10% cut per year). A separate accelerator clause allowed industries to request faster tariff phaseouts on commodities, subject to mutual agreement on each side of the border.

The FTA was expected to strengthen the economies of both countries, to serve as a model for the Uruguay Trade Round of the General Agreement on Tariffs and Trade, and to demonstrate to the rest of the world the benefits of dismantling trade barriers.

When implemented, the FTA agreement provisions would eliminate all bilateral tariffs within 10 years; remove virtually all import and export restrictions; reduce or eliminate many nontariff barriers; resolve many longstanding bilateral irritants; establish an effective dispute settlement mechanism; and liberalize trade in several areas including agricultural, automobiles, energy, financial services, and Government procurement. Because Canadian tariffs averaged 10% (as opposed to 4% in the United States), eliminating them would create new opportunities for U.S. businesses.

Canada, in turn, would gain duty-free access to the world's largest national economy.

The FTA established binding rules for all new measures affecting a comprehensive group of service sectors. Generally, neither country would discriminate against service providers from the other country in about 150 sectors. In 1986, trade in services between the countries amounted to $11.5 billion.

An open investment climate is an important element of a free-trade agreement. It prevents trade distortions and facilitates growth in production and employment. Under the FTA, Canada would make permanent its recent policy of not screening most new investments and would reduce significantly the screening of direct acquisitions.

The FTA would end most restrictions on imports and exports of energy between Canada and the United States. The result would be an increase in energy security.

Commodity	Existing tariffs[1] (percent)		Phaseout
	Canada	United States	
METALS			
Chromium	10.2	3.7	5-year elimination starting Jan. 1, 1989; 20% reduction per year.
Cobalt	10.2	5.5	Do.
Columbium (niobium)	4.0	4.9	Do.
Copper:			
Refined	10.3	1.0	Do.
Alloys	10.2	1.0	10-year elimination starting Jan. 1, 1989; 10% reduction per year.
Ferroalloys:			
Ferromolybdenum	10.2	4.5	5-year elimination starting Jan. 1, 1989; 20% reduction per year.
Ferrosilicon chromium	10.2	10.0	Immediate lifting of tariffs on Jan. 1, 1989.
Ferrotitanium	10.2	3.7	5-year elimination starting Jan. 1, 1989; 20% reduction per year.
Ferrotungsten and ferrosilicon tungsten	10.2	5.6	Do.
Ferrovanadium	10.2	4.2	Do.
Minor metals:			
Beryllium, waste and scrap	10.2	8.5	Do.
Germanium, unwrought	10.2	3.7	Do.
Magnesium containing at least 99.8% by weight of Mg	4.0	8.0	10-year elimination starting Jan. 1, 1989; 10% reduction per year.
Lead:			
Refined (metal content)	10.2	3.5	Do.
Oxide	12.5	15.0	5-year elimination starting Jan. 1, 1989; 20% reduction per year.
Rare-earth metals	12.5	3.7	5-year elimination starting Jan. 1, 1989; 20% reduction per year.
Vanadium	10.2	3.0	Do.
Zinc:			
Refined	0	1.5	10-year elimination starting Jan. 1, 1989; 10% reduction per year.
INDUSTRIAL MINERALS			
Graphite, powder	9.2	0	5-year elimination starting Jan. 1, 1989; 20% reduction per year.
Granite, cut	5.5	4.2	Do.
Gypsum, wallboard	9.4	2.4	10-year elimination starting Jan. 1, 1989; 10% reduction per year.

[1]Tariff rates under the General Agreement on Tariffs and Trade (GATT).

Sources: Department of Energy, Mines and Resources, Ottawa, Canada, 1988; Metals Week, New York, Dec. 21, 1987, p. 7.

A binational dispute-settlement mechanism would be established to handle inevitable disagreements that arise in a trading relationship as large and complex as that of Canada and the United States. This mechanism was expected to expedite resolution of disputes while retaining availability of both countries' domestic trade laws. Important new ground was being broken. Either Government could seek a review of an antidumping or countervailing duty determination by a bilateral panel. The decision in each case would be binding on the parties. At the outset, each side would apply its own domestic law, but during a 5-year period, which can be extended 2 years, the two Governments would work toward establishing a new regime to address problems in subsidization and dumping.

Some sectors of the U.S. mining industry (coal, copper, lead, uranium, and zinc) expressed opposition to the pact. Free trade was expected to benefit Canada economically more than the United States, which would be throwing open the largest market in the world in return for greater access to a market only one-tenth as large. However, Canada was seen as a growing market. From 1980 to 1986, U.S. exports to Canada increased by 40% or $15 billion, while U.S. exports to the rest of the world declined by almost $14 billion. Canada bought twice as much in goods from the United States than did Japan and more than the Federal Republic of Germany, Mexico, and the United Kingdom combined. Canada sold 75% of its exported goods to the United States, while 22% of exported U.S. goods went north. In 1986, the United States purchased 71% of Canada's mineral exports.

Economic analyses on both sides of the border suggested that the agreement presented a "win-win" proposition—it would contribute to economic growth, income, and employment in both countries. The U.S. Department of Commerce estimated that the elimination of tariffs alone would result in a $25 billion increase in trade between the two countries over a 5-year period, with more than 14,000 new U.S. jobs created.

Table 3.—Canada: Exports and reexports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	52,799	45,434	40,683	United Kingdom 1,409; West Germany 1,099.
Metal including alloys:				
Scrap	114,674	125,019	102,573	Japan 17,316; Italy 1,006.
Unwrought	1,051,007	1,163,875	857,146	NA.
Semimanufactures	55,979	59,859	52,870	Indonesia 2,695; Bahrain 1,553.
Cobalt:				
Oxides and hydroxides	268	374	--	All to United Kingdom.
Copper:				
Ore and concentrate, Cu content	320,617	341,392	2,651	Japan 253,686; China 30,373; Norway 20,222.
Metal including alloys:				
Scrap	62,995	70,755	47,753	West Germany 9,972; Italy 2,586.
Unwrought	280,043	304,891	193,618	United Kingdom 54,037; West Germany 15,036.
Semimanufactures	53,705	50,962	42,427	Bangladesh 2,476; Venezuela 1,516.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand ton	32,124	30,995	9,449	United Kingdom 5,813; West Germany 3,990.
Pyrite, roasted	134,987	12,950	12,950	
Metal:				
Scrap	952,375	898,156	628,442	Republic of Korea 98,619; Turkey 38,736.
Pig iron, cast iron, related materials	610,527	556,610	136,343	Netherlands 260,217; China 52,105.
Ferroalloys:				
Ferromanganese	43,584	45,132	45,132	
Unspecified	37,838	57,842	44,081	Japan 8,775; United Kingdom 1,584.
Steel, primary forms	77,137	233,428	205,623	Turkey 20,869; Italy 4,832.
Semimanufactures:				
Bars, rods, angles, shapes, sections	958,340	1,062,153	1,032,121	China 12,543; Mexico 3,371.
Universals, plates, sheets	1,480,013	1,477,585	1,146,231	Italy 35,385; Mexico 26,585.
Rails and accessories	99,755	103,586	36,770	Mexico 50,404; Indonesia 10,630.
Wire	164,345	193,888	192,305	Republic of South Africa 299; Saudi Arabia 215.
Tubes, pipes, fittings	443,057	365,725	359,219	Barbados 1,123; Italy 1,073.
Castings and forgings, rough	122,575	120,693	119,815	United Kingdom 417; Peru 165.

See footnotes at end of table.

Table 3.—Canada: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Lead:				
Ore and concentrate	93,658	112,918	6,367	Japan 53,751; Belgium-Luxembourg 16,400; Italy 11,452.
Metal including alloys:				
Scrap	11,393	25,564	2,991	Brazil 10,496; West Germany 3,744.
Unwrought	114,007	111,853	82,546	United Kingdom 20,981; Italy 3,268.
Semimanufactures	16,021	23,225	18,241	Brazil 1,377; Japan 1,351.
Magnesium: Metal including alloys, manufactures	4,761	4,767	1,242	United Kingdom 1,382; Japan 1,177.
Nickel:				
Ore and concentrate	81,276	71,712	--	NA.
Metal including alloys:				
Scrap	4,948	6,252	4,011	Netherlands 1,200; United Kingdom 318.
Unwrought	81,772	86,057	--	NA.
Semimanufactures	12,412	10,880	7,856	Japan 1,006; Belgium-Luxembourg 505.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$30,547	$22,717	$15,861	United Kingdom $6,475; West Germany $160.
Silver:				
Ore and concentrate[2] do	$132,047	$183,974	$8,957	Japan $86,151; United Kingdom $71,499.
Waste and sweepings[2] do	$84,339	$82,245	$46,543	United Kingdom $22,287; West Germany $8,614.
Metal including alloys, unwrought and partly wrought do	$267,646	$236,572	$235,998	Spain $445; Jamaica $41.
Tin: Ore and concentrate, Sn content	393	3,725	1,886	United Kingdom 1,762; Mexico 77.
Uranium and/or thorium: Ore and concentrate value, thousands	$171,036	$120,217	$91,853	United Kingdom $14,318; France $13,714.
Zinc:				
Ore and concentrate, Zn content	396,102	433,220	13,393	Belgium-Luxembourg 163,547; Japan 53,851; France 43,542.
Metal including alloys:				
Unwrought	555,616	427,175	333,126	United Kingdom 29,066; Hong Kong 5,685.
Semimanufactures	9,359	5,103	4,928	Colombia 94; Brazil 49.
Other:				
Ores and concentrates	273,612	166,608	22,369	Japan 41,010; France 40,789; West Germany 25,656.
Ashes and residues	41,007	47,798	11,768	West Germany 6,385; Norway 5,019.
Base metals including alloys, all forms	4,712	4,903	3,600	United Kingdom 443; Belgium-Luxembourg 237.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	65	265	265	
Artificial:				
Corundum	129,359	128,844	120,938	United Kingdom 7,528; Belgium-Luxembourg 270.
Silicon carbide value, thousands	$46,781	$52,225	$47,889	Japan $1,468; West Germany $653.
Dust and powder of precious and semi-precious stones do	$326	$204	$196	Australia $7; Japan $1.
Grinding and polishing wheels and stones do	$5,638	$6,297	$5,542	West Germany $160; China $85.
Asbestos, crude	721,560	752,081	149,859	Japan 113,658; India 38,477.
Barite and witherite	1,677	6,627	6,622	West Germany 5.
Cement value, thousands	$135,122	$139,543	$139,072	Cameroon $93; Republic of South Africa $64.
Clays, crude	5,553	2,269	2,176	Japan 36; Pakistan 27.
Diamond:				
Gem, not set or strung value, thousands	$27,011	$22,914	$9,788	Belgium-Luxembourg $6,183; Israel $4,979.
Industrial stones do	$588	$550	$357	Ireland $159; New Zealand $10.
Fertilizer materials: Manufactured:				
Ammonia thousand tons	963	928	928	
Nitrogenous do	1,566	1,740	1,552	Australia 39; El Salvador 21.
Phosphatic	45,888	21,879	21,576	Nicaragua 239; St. Christopher and Nevis 38.
Potassic thousand tons	9,981	9,894	5,881	Brazil 777; Japan 564.
Unspecified and mixed do	249	257	220	Australia 20; Costa Rica 10.

See footnotes at end of table.

Table 3.—Canada: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Gypsum and plaster thousand tons	5,880	5,906	5,906	
Lime	194,091	189,693	189,535	Bermuda 100; Greenland 27.
Magnesite, crude value, thousands	$26,299	$29,913	$24,510	Republic of South of Africa $818; West Germany $722.
Pigments, mineral: Iron oxides and hydroxides, natural and processed	15,740	16,216	16,192	Trinidad and Tobago 10; United Kingdom 6.
Precious and semiprecious stones other than diamond, synthetic value, thousands	$6,933	$10,262	$5,346	France $1,282; United Kingdom $534.
Salt and brine thousand tons	2,289	2,553	2,545	St. Pierre and Miquelon 2; Saudi Arabia 2.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	185,090	398,813	357,270	Barbados 35,360; Japan 6,112.
Worked value, thousands	$19,289	$22,700	$20,659	Japan $1,077; United Kingdom $395.
Dolomite, chiefly refractory-grade	535,648	728,722	728,714	United Kingdom 8.
Limestone other than dimension	1,197,313	1,350,344	1,340,392	Bermuda 9,952.
Quartz and quartzite	112,762	88,394	88,394	
Sand other than metal-bearing	242,268	249,879	249,610	France 135; Republic of South Africa 36.
Sand and gravel	(3)	--		
Sulfur:				
Elemental, crude including native and byproduct thousand tons	7,819	6,257	611	U.S.S.R. 848; Morocco 729.
Sulfuric acid	745,895	755,651	755,639	St. Christopher and Nevis 8; Bermuda 3.
Other:				
Crude	(3)	--		
Slag and dross, not metal-bearing value, thousands	$124,162	$170,521	$51,259	France $38,713; West Germany $30,289.
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Briquets of anthracite and bituminous coal	20	13	--	All to Israel.
All grades excluding briquets thousand tons	27,572	25,900	303	Japan 17,005; Republic of Korea 3,602; Brazil 1,043.
Coke and semicoke	169,155	108,807	103,186	Belgium-Luxembourg 5,621.
Gas, manufactured million cubic feet	(4)	--		
Peat including briquets and litter	446,826	535,129	501,875	Japan 31,549; Saudi Arabia 576.
Petroleum:				
Crude thousand 42-gallon barrels	175,241	211,356	210,160	Republic of Korea 873; Japan 320.
Refinery products:				
Liquefied petroleum gas do	203,127	166,124	165,984	Mexico 145; St. Pierre and Miquelon 1.
Gasoline, motor do	14,989	12,888	12,369	Japan 215; Cuba 214.
Distillate fuel oil do	18,751	22,725	20,534	United Kingdom 475; St. Pierre and Miquelon 314.
Lubricants do	505	544	516	United Kingdom 5; St. Pierre and Miquelon 3.
Residual fuel oil do	11,293	8,279	8,194	Switzerland 85.
Asphalt do	2,426	1,493	1,297	Comoros 41; West Germany 11.
Petroleum coke do	(3)	--		

[r]Revised. NA Not available.
[1]Table prepared by H. D. Willis.
[2]May include other precious metals.
[3]Revised to zero.
[4]Reclassified as liquefied petroleum gas.

Table 4.—Canada: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals, unspecified	6,985	3,900	3,777	United Kingdom 67; China 27.
Aluminum:				
Ore and concentrate thousand tons	2,074	2,113	48	Brazil 1,162; Guinea 315; Sierra Leone 241.
Oxides and hydroxides ____do____	1,561	1,744	254	Jamaica 618; Australia 502; Japan 269.
Metal including alloys:				
Scrap	52,424	67,610	67,519	United Kingdom 41; Jamaica 21.
Unwrought	59,756	64,519	50,912	West Germany 2,289; Republic of South Africa 2,214.
Semimanufactures	171,340	173,602	144,795	France 8,033; Belgium-Luxembourg 5,003.
Beryllium: Metal including alloys, all forms value, thousands	$532	$615	$592	West Germany $18; United Kingdom $4.
Chromium:				
Ore and concentrate, Cr content	11,324	16,093	5,933	Republic of South Africa 4,246; Philippines 3,335.
Oxides and hydroxides	2,006	2,476	1,222	West Germany 781; United Kingdom 360.
Cobalt:				
Oxides and hydroxides	192	31	9	Finland 11; United Kingdom 11.
Copper:				
Ore and concentrate, Cu content	59,650	55,171	9,666	Chile 35,863; Poland 5,104.
Metal including alloys:				
Scrap	85,200	65,768	65,496	Haiti 128; France 62.
Unwrought	19,292	20,770	8,693	Zaire 11,812; Republic of South Africa 112.
Semimanufactures	36,300	40,357	25,620	Japan 3,337; West Germany 2,837.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite thousand tons	5,800	5,367	4,638	Brazil 700; Argentina 24.
Metal:				
Scrap ____do____	884	750	750	
Pig iron, cast iron, related materials	15,847	18,063	13,000	Brazil 5,008; West Germany 41.
Ferroalloys:				
Ferromanganese	27,482	20,283	5,891	Mexico 6,022; Republic of South Africa 2,477.
Unspecified	97,227	73,669	30,437	Republic of South Africa 20,008; Greece 5,000.
Steel, primary forms	146,491	255,465	9,446	United Kingdom 60,278; Netherlands 56,588; West Germany 53,914.
Semimanufactures:				
Bars, rods, angles, shapes, sections	596,510	614,910	98,345	Spain 114,225; Brazil 69,775.
Universals, plates, sheets	1,017,378	875,251	290,289	West Germany 83,547; United Kingdom 78,303.
Hoop and strip	51,195	38,933	29,254	West Germany 2,897; Japan 2,611.
Rails and accessories	71,975	83,196	8,360	Japan 49,350; United Kingdom 12,430.
Wire	60,476	60,556	18,418	Belgium-Luxembourg 8,590; United Kingdom 5,946.
Tubes, pipes, fittings	341,139	154,578	47,172	Japan 57,238; Brazil 11,834.
Castings and forgings, rough	27,201	34,758	30,319	Italy 955; West Germany 814.
Lead:				
Ore and concentrate, Pb content	6,141	10,707	354	Peru 5,458; Australia 4,672.
Oxides	2,068	2,148	1,767	Mexico 203; Republic of South Africa 116.
Metal including alloys:				
Scrap	44,308	61,530	61,238	Australia 292.
Unwrought	5,676	4,309	3,316	Brazil 535; Mexico 455.
Semimanufactures	267	545	493	United Kingdom 27; Denmark 24.
Magnesium: Metal including alloys:				
Scrap	152	378	378	
Unwrought	3,802	3,146	2,817	Norway 239; France 90.
Semimanufactures value, thousands	$7,239	$9,047	$7,324	Norway $998; United Kingdom $725.
Manganese:				
Ore and concentrate: Metallurgical-grade, Mn content	102,661	95,205	3,017	France 35,745; Gabon 33,654; Republic of South Africa 11,543.
Oxides	4,204	6,027	4,593	Japan 1,239; Republic of South Africa 84.

See footnotes at end of table.

Table 4.—Canada: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Manganese —Continued				
Mercury ——— 76-pound flasks	1,189	2,234	1,508	Netherlands 377; United Kingdom 261.
Molybdenum: Metal including alloys, all forms ——— value, thousands	$1,045	$1,485	$1,371	Austria $103; Netherlands $8.
Nickel:				
Ore and concentrate, Ni content	19	1,094	768	United Kingdom 154; Belgium-Luxembourg 99.
Matte and speiss, Ni content	5,059	8,273	1	Australia 8,272.
Metal including alloys:				
Scrap	26,514	28,964	13,980	United Kingdom 9,489; Norway 2,348.
Unwrought	2,452	2,630	810	Norway 1,737; United Kingdom 38.
Semimanufactures	3,328	3,150	1,830	West Germany 914; United Kingdom 200.
Platinum-group metals: Metals Including alloys, unwrought and partly wrought: Platinum ——— value, thousands	$4,962	$26,954	$12,214	United Kingdom $10,797; Republic of South Africa $3,872.
Silver:				
Ore and concentrate [2] ———do	$20,689	$23,259	$6,029	Peru $11,197; Guyana $1,876.
Waste and sweepings [2] ———do	$254,926	$451,131	$431,138	Cuba $6,458; Nicaragua $3,725.
Metal including alloys, unwrought and partly wrought ———do	$114,480	$25,218	$24,869	West Germany $308; United Kingdom $20.
Tantalum: Metal including alloys, all forms ———do	$324	$292	$291	United Kingdom $1.
Tin:				
Ore and concentrate, Sn content	579	202	202	
Metal including alloys:				
Unwrought	3,785	3,881	1,462	Brazil 951; Bolivia 681.
Semimanufactures	48	132	111	Brazil 15; Bolivia 5.
Titanium: Oxides	12,547	7,936	1,581	West Germany 5,327; Belgium-Luxembourg 509.
Tungsten:				
Ore and concentrate, W content	12	11	10	China 1.
Metal including alloys, all forms value, thousands	$2,455	$2,305	$2,030	West Germany $116; United Kingdom $98.
Uranium and/or thorium:				
Ore and/or concentrate ———do	$55,565	$65,525	$37	Republic of South Africa $32,139; Comoros $11,775; Australia $11,125.
Metal including alloys, all forms ———do	$223	$105	$36	West Germany $59; Malaysia $10.
Zinc:				
Ore and concentrate, Zn content	9,595	29,541	5,090	Peru 21,127; Bolivia 2,332.
Oxides	1,303	1,628	1,397	Netherlands 140; Mexico 71.
Metal including alloys:				
Scrap	435	544	544	
Unwrought	1,816	7,441	938	Spain 2,878; France 2,513; Belgium-Luxembourg 1,003.
Semimanufactures	1,390	1,263	1,141	Belgium-Luxembourg 47; Mexico 30.
Other:				
Ores and concentrates, metal content	25,678	17,239	6,701	Australia 6,644; Republic of South Africa 3,867.
Oxides and hydroxides	16,586	19,361	17,354	Greece 766; United Kingdom 452.
Ashes and residues	32,729	36,021	29,719	India 6,194; Belgium-Luxembourg 108.
Base metals including alloys, all forms value, thousands	$68,132	$59,527	$42,792	Zaire $5,647; France $3,830.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	28,432	27,943	25,718	Italy 1,589; Iceland 422.
Artificial: Silicon carbide	(3)	--		
Dust and powder of precious and semi-precious stones value, thousands	$2,457	$2,105	$1,200	U.S.S.R. $851; Denmark $24.
Grinding and polishing wheels and stones ———do	$19,569	$23,733	$13,277	Italy $3,599; West Germany $2,058.
Asbestos, crude	374	325	305	Zimbabwe 20.
Barite and witherite	27,131	10,525	10,029	Netherlands 489; United Kingdom 7.
Boron materials:				
Crude natural borates value, thousands	$580	$460	$460	
Oxides and acids	4,803	5,148	4,731	Italy 377; Japan 39.
Cement	372,796	490,137	251,145	Spain 179,689; Greece 29,806.
Chalk ——— value, thousands	$1,131	$711	$654	West Germany $53.

See footnotes at end of table.

Table 4.—Canada: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Clays, crude	828,456	877,583	767,276	Greece 97,850; United Kingdom 10,774.
Cryolite and chiolite	518	3,537	1,156	France 1,912; Netherlands 251.
Diamond:				
Gem, not set or strung value, thousands	$117,287	$118,978	$22,779	Belgium-Luxembourg $49,293; Israel $29,834.
Industrial stones do	$6,085	$6,871	$5,175	Ireland $1,410; United Kingdom $85.
Diatomite and other infusorial earth	24,226	26,338	26,338	
Feldspar, fluorspar, related materials value, thousands	$12,291	$16,642	$1,980	Mexico $8,162; Morocco $3,227; Spain $2,857.
Fertilizer materials:				
Crude, n.e.s	24,025	20,190	17,807	U.S.S.R. 2,081; United Kingdom 132.
Manufactured:				
Ammonia	31,793	26,775	26,775	
Nitrogenous	267,479	282,857	146,747	East Germany 67,330; Trinidad and Tobago 50,528.
Phosphatic	444,128	439,538	435,781	France 2,999; Belgium-Luxembourg 625.
Potassic	65,230	50,386	50,026	Italy 338; Israel 22.
Unspecified and mixed	31,229	29,656	28,903	Japan 257; United Kingdom 169.
Graphite, natural value, thousands	$1,691	$2,143	$1,929	West Germany $94; Madagascar $53.
Gypsum and plaster	146,435	242,953	54,069	Mexico 101,377; Spain 87,393.
Lime	23,056	46,916	44,857	United Kingdom 2,059.
Magnesite, crude	46,947	46,782	34,165	Italy 6,154; Brazil 3,449.
Mica:				
Crude including splittings and waste value, thousands	$538	$592	$592	
Worked including agglomerated splittings do	$2,413	$2,741	$2,106	France $494; India $141.
Nitrates, crude	1,967	7,941	484	Chile 7,457.
Phosphates, crude thousand tons	2,622	2,388	2,287	Morocco 64; Togo 37.
Pigments, mineral: Iron oxides and hydroxides, processed	7,754	8,484	6,731	West Germany 611; Spain 541.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$13,225	$16,504	$5,650	Thailand $2,464; Colombia $1,759.
Synthetic do	$4,379	$6,354	$2,289	Austria $1,362; West Germany $986.
Pyrite, unroasted do	$94	$96	$96	
Salt and brine thousand tons	1,257	1,331	865	Mexico 301; Chile 110.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	3,520	1,087	1,049	France 38.
Sulfate, manufactured	67,485	55,226	17,653	United Kingdom 23,357; Norway 4,695.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	48,681	47,918	18,686	Republic of South Africa 20,322; Italy 3,168.
Worked value, thousands	$17,287	$27,251	$3,111	Italy $19,506; Spain $1,704.
Dolomite, chiefly refractory-grade	3,667	2,763	2,763	
Gravel and crushed rock	598,197	551,051	548,610	Turkey 2,000; Italy 324.
Limestone other than dimension thousand tons	2,074	2,357	2,357	
Quartz and quartzite	339	349	318	Japan 30; Brazil 1.
Sand other than metal-bearing thousand tons	1,598	1,638	1,638	
Sulfur:				
Elemental:				
Crude including native and byproduct	3,168	10,760	10,721	West Germany 34; unspecified 5.
Colloidal, precipitated, sublimed	74	31	22	West Germany 9.
Sulfuric acid	17,307	29,126	19,402	Switzerland 9,710; West Germany 14.
Talc, steatite, soapstone, pyrophyllite	41,307	39,520	38,958	France 295; United Kingdom 135.
Other:				
Crude value, thousands	$10,756	$12,964	$12,227	Republic of South Africa $380; Netherlands $209.
Slag and dross, not metal-bearing	208,300	188,394	188,385	United Kingdom 9.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2,296	3,766	3,746	India 20.
Carbon black	7,647	24,762	24,261	Singapore 201; Mexico 153.

See footnotes at end of table.

Table 4.—Canada: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coal:				
Briquets of anthracite and bituminous coal	5,828	251	130	United Kingdom 121.
Lignite including briquets	7,236	10,397	10,352	Japan 45.
All grades excluding briquets thousand tons	15,016	13,368	13,363	Republic of South Africa 5.
Coke and semicoke	783,719	881,084	820,577	East Germany 37,965; West Germany 22,542.
Petroleum:				
Crude thousand 42-gallon barrels	97,527	124,175	10,185	United Kingdom 54,572; Venezuela 14,964; Nigeria 14,632.
Refinery products:				
Liquefied petroleum gas value, thousands	$89,660	$141,852	$141,591	United Kingdom $209; West Germany $30.
Gasoline, motor do	$200,814	$172,421	$105,949	United Kingdom $16,075; Netherlands $13,784.
Mineral jelly and wax thousand 42-gallon barrels	72	101	93	United Kingdom 4; France 2.
Kerosene and jet fuel do	10,081	12,441	6,399	Italy 1,190; Bermuda 1,050.
Distillate fuel oil do	4,075	5,055	3,585	Venezuela 892; Algeria 227.
Lubricants do	2,223	4,082	1,643	Netherlands 1,338; Venezuela 446.
Residual fuel oil do	7,083	9,182	2,080	Venezuela 4,932; Netherlands Antilles 953.
Bitumen and other residues do	534	1,045	566	Venezuela 381; Switzerland 97.
Petroleum coke do	4,764	5,175	4,978	Unspecified 197.

[r]Revised.
[1]Table prepared by H. D. Willis.
[2]May include other precious metals.
[3]Revised to zero.

COMMODITY REVIEW

METALS

Aluminum.—All smelters were reported to be operating at capacity at yearend except Alcan Aluminium Ltd.'s Arvida works at Jonquière, Quebec, which was operating at 88% capacity. Alcan's smelter at Shawinigan, Quebec, closed in October 1987 after failure to reach agreement on a new labor contract, and it remained closed at yearend.

Alcan resumed construction plans for its Laterrière, Quebec, primary aluminum smelter. The project was scaled back to 200,000 tons per year of capacity at an estimated cost of $450 million. Completion was estimated to take 5 to 7 years. State-of-the-art technology, cost controls, and lower cost hydroelectric power were expected to hold down operating costs. As capacity was brought on-stream at Laterrière, Alcan would phase out capacity at its existing smelter at Jonquière so there would be no net increase in the size of Alcan's Quebec operations. As a fully integrated aluminum producer, Alcan was the largest producer of primary aluminum in North America.

Aluminerie de Bécancour's new smelter at Bécancour, Quebec, became fully operational in February 1987. The smelter had a capacity of 230,000 tons per year with two 150,000-ton-per-year potlines. A feasibility study was being conducted for a third 150,000-ton-per-year potline at an estimated cost of $380 million.

Canada remained a major import source of aluminum ingot for the United States.

Copper.—The largest copper producer in Canada was Highland Valley Copper (HVC), a partnership of Cominco Ltd. (50%), Lornex Mining Corp. Ltd. (45%), and Highmont Mining Corp.(5%). The partnership would be one of the world's largest single producers of copper concentrate. After consolidation of equipment and oper-

ations in late 1988, mill throughput would be approximately 145,000 tons per day, and production of copper in concentrate would be as high as 200,000 tons per year. Two-thirds of HVC's output was sold under contract to Japanese smelters.

Minnova Inc. announced it would put its Ansil copper project near Rouyn-Noranda, Quebec, into production, with startup expected by the first part of 1989. The project, which had an estimated total capital cost of about $55 million, involved a massive sulfide copper deposit with probable reserves of about 1.5 million tons grading 7.2% copper, 0.8% zinc, 1.7 grams of gold, and 25.9 grams of silver per ton. Production of 33,000 tons per year of copper in concentrate was planned.

The Quebec Provincial government was trying to persuade Noranda Ltd. to reopen its Gaspé Mine which was closed in April 1987 as a result of an underground fire that caused extensive damage. Noranda estimated that rehabilitation costs would be about $15 million, and it had not made a decision to reopen by yearend. The Quebec government had offered to help finance reopening the mine with an interest-free loan of about $10 million. The Gaspé smelter continued to operate throughout the year on toll material and possibly some feed from other Noranda mines.

Geddes Resources Ltd. raised an additional $4 million in flow-through share financing and continued with the exploration of the Windy Craggy copper-cobalt project in northwestern British Columbia. The 1987 exploration program called for a 7,000-foot adit, and crosscutting, drifting, and diamond drilling to further delineate the deposit. The Windy Craggy deposit has been estimated to contain about 300 million tons of ore at a grade of 1.5% copper, 2 pounds of cobalt per ton, and minor amounts of gold and silver.

Sherritt Gordon Mines Ltd. sold its Ruttan Mine in Manitoba to Hudson Bay Mining and Smelting Co. Ltd. (HBMS) in July 1987. The Ruttan Mine produced about 25,000 tons per year of copper in concentrates, which was processed at the HBMS smelter. The mine also produced a significant amount of zinc. The sale improved the reserve base of the HBMS.

Gold.—According to EMR, gold reserves of Canada, including proven and probable ore, have doubled since 1981. Recoverable reserves were estimated at 1,200 tons, which is equivalent to about 10 times 1987 production. Twelve new primary gold mines commenced production in 1987, and there was at least one gold operation in every Province except Prince Edward Island.

In August 1987, Placer Development Ltd., Dome Mines Ltd., and Campbell Red Lake Mines Ltd. merged into one corporate entity: Placer Dome Inc. This resulted in the creation of one of the largest gold producers in the world outside the Republic of South Africa and the Soviet Union. Placer Dome has a production capacity of more than 1 million troy ounces of gold annually.

Queenstake Resources Ltd.'s 350-ton bucketline dredge, acquired and renovated at a cost of almost $1 million, completed its 7-year mining operations at Clear Creek, Yukon Territory. In 1987, the gold content of the Clear Creek gravel continued to decline to the point where the project was uneconomical. The company terminated dredging operations on Clear Creek at the close of the 1987 season. Queenstake was investigating other dredgeable gold placer reserves so that the 2,250-cubic-yard-per-day bucketline dredge could be relocated.

Saskatchewan Mining Development Corp. (SMDC) initiated production in early 1987 at its Star Mine. The 220-ton-per-day operation was the first primary gold producer in Saskatchewan in 50 years. Mascot Gold Mines Ltd. opened the Nickel Plate Mine near Hedley, British Columbia, in midyear. The $53 million open pit operation has a capacity of 2,500 tons per day. Hope Brook Gold Inc. began heap leaching at its mine in southwestern Newfoundland. This was to be phased out in 1988 after the mill and underground mine were started. Annual gold production was expected to be 120,000 ounces.

Iron Ore.—The iron ore operations produced 39.9 million tons, which represented 74% of capacity. Iron Ore Co. of Canada (IOC) was a large producer of iron ore. It operated an open pit mine, concentrator, and pellet plant at Labrador City, Newfoundland. The other two large producers were Quebec Cartier Mining Co. (QCM) and Wabush Mines. In 1987, IOC shipped 13.6 million tons of iron ore, QCM about 16 million tons, and Wabush, 5.2 million tons. Strikes at IOC and Wabush resulted in the closure of operations for 1 and 2 months, respectively. Productivity increased in the industry due to cost control and other improvements.

Lead and Zinc.—Despite improved prices, pressure remained on the industry to re-

duce costs and maintain low low inventories. Overcapacity, particularly in the European smelting industry, continued to plague the Canadian lead and zinc industry. Metal production was well below capacity because of a strike at Cominco's metallurgical facility at Trail, British Columbia, and the Sullivan Mine at Kimberly, British Columbia. The labor dispute lasted from May to September 1987.

Newfoundland Zinc Mines Ltd. reopened its Daniel's Harbour zinc mine that had been closed since Apr. 1986. The mine was expected to produce 40,000 tons per year. Curragh Resources Corp. increased zinc capacity at its Faro Mine in the Yukon by 45,000 tons to 180,000 tons per year. Pine Point Ltd.'s mine in the Northwest Territories closed at midyear. Milling of stockpiled ore was expected to continue until the spring of 1988.

Nickel.—Nickel producers were operating at an average effective capacity of more than 90%. Strong demand, a tight market, and relatively low inventories caused nickel prices to rise in the second half of the year. Inco Ltd. and Falconbridge Ltd. both increased nickel production in Canada to meet international market conditions. Both companies were also continuing their research and development efforts to assure that they conform to the 1994 sulfur dioxide emission limits set in December 1985 by the Ontario Provincial government. Inco was required to reduce emissions from 685,000 tons per year in 1986 to 265,000 tons per year in 1994. Falconbridge's limit was to go from 154,000 tons per year in 1986 to 100,000 tons in 1994.

Inco resumed production in midyear at the newly reopened Crean Hill Mine at Sudbury, Ontario. The mine, closed since 1978, became a state-of-the-art all-electric mine converted to vertical retreat bulk mining. Crean Hill Mine was scheduled to reach full production of 3,000 tons per day by 1989. The all-electric mine was one of the most technologically sophisticated in Canada.

HBMS and Outokumpu Mines Ltd. initiated development of the Namew Lake deposit in northern Manitoba. Reserves were estimated at 2.6 million tons grading 2.4% nickel and 0.9% copper with minor values in platinum and palladium. Production of about 8,000 tons per year of contained nickel in concentrate was planned for the latter part of 1988. This would be the first new underground nickel mine in Canada since 1979.

Silver.—Most of Canada's silver was produced as a byproduct of base-metal production. The rise in silver was mainly from increased base-metal production. Equity Silver Mines, near Houston, British Columbia, produced 5 million tony ounces of silver after completion of its mill expansion. A new silver producer, Silverside Resources Inc., near Cobalt, Ontario, was expected to begin producing about 2,900 ounces of silver per day. The rebuilt Penna mill of Agnico-Eagle Mines Ltd. in Cobalt, Ontario, resumed operation in early 1987 after being destroyed by fire in 1986.

Other Metals.—Hecla Mining Co. and Highwood Resources Ltd. continued their feasibility and marketing study on Highwood Resource's Thor Lake beryl deposit near Yellowknife, Northwest Territories. A $25 million mine and processing plant was being considered. An estimated 1.6 million tons of 0.85% beryllium oxide reserves, including 435,000 tons grading 1.4% beryllium oxide, had been discovered. Cobalt was recovered as a byproduct of nickel operations and refined by Inco at Port Colborne, Ontario, and Sherritt Gordon Mines Ltd. in Alberta. Both plants operated near effective capacity in 1987. A 60,000-ton-per-year magnesium plant was under construction at Bécancour, Quebec, by Norsk Hydro A/S. Initial production of 60,000 tons per year was scheduled for the first half of 1989. Magnesium Co. of Canada Ltd. was planning construction of a 62,500-ton-per-year plant near High River, Alberta. Production of 12,500 tons per year was scheduled to begin in late 1989. Rio Algom Ltd. announced it intended to repurchase the East Kemptville, Nova Scotia, tin mine from a consortium of banks led by Bank of America (Canada). The mine operated throughout 1987 with production of tin concentrate estimated at 3,397 tons. Canada Tungsten Mining Corp. Ltd.'s tungsten mine in the Northwest Territories remained closed in 1987.

INDUSTRIAL MINERALS

Asbestos.—Canada remained the largest producer of asbestos among market economy countries, even though production declined from more than 1 million tons in 1980 to 665,000 tons in 1987. Health hazards associated with asbestos fibers, uncertainty regarding future regulations, and low-cost production from other countries significantly hurt Canadian production. There were a

number of mine closings and a major rationalization in the Canadian asbestos industry. The Lake Asbestos of Quebec Ltd. (LAQ), Asbestos Corp. Ltd., and Bell Asbestos Mines Ltd. mining and milling operations at Thetford Mines & Black Lake, Quebec, were consolidated into a limited partnership, LAB Chrysolite Inc.

Potash.—Installed potash capacity in Canada in 1987 was 10.9 million tons. Capacity utilization was 67%. Manitoba Potash Corp. continued its development efforts on its property near Russell, Manitoba. Reserves of 165 million tons grading 24.5% K_2O were outlined. The K2 Mine of International Minerals & Chemical Corp. near Esterhazy, Saskatchewan, continued to experience water inflow problems. The company was continuing its grouting program and had reduced the inflow to manageable levels. Kalium Chemicals, a division of PPG Inc., completed its expansion program at the Belle Plaine Mine to reach a rated capacity of 1.2 million tons K_2O. BP Resources Canada Ltd. held a commercially viable potash deposit near Sussex, New Brunswick. However, because of the depressed potash market, the company deferred until 1988 any decision to proceed with its shaft-sinking program. The two other mines near Sussex, owned by Denison Potacan Potash Co., and Potash Co. of America (Canada), respectively, operated throughout the year.

Other Industrial Minerals.—Canadian cement capacity remained unchanged in 1987 at 16.5 million tons per year. Increased demand kept most cement plants operating at near capacity. Domtar Inc. continued development of its underground gypsum mine at Caledonia, Ontario. Reserves were estimated to be sufficient for 75 years.

The Canadian Salt Co. Ltd. continued development of its underground rock salt mine at Pugwash, Nova Scotia. Late in 1987, the Quebec government announced plans to sell its wholly owned Mines Seleine Inc. salt mine. The mine produced salt from a deposit on one of the Magdalen Islands in the Gulf of St. Lawrence. Canadian Salt, a subsidiary of Morton Thiokol Co. of the United States, expressed interest in the mine.

Noranda Inc. announced it would build a 350,000-ton-per-year sulfuric acid plant at an estimated cost of $130 million, at its Rouyn, Quebec, copper smelter. The project was in response to Quebec Provincial law mandating a 50% reduction in sulfur dioxide emissions by January 1, 1990. Larder Minerals Inc. was expected to become the fifth major producer of talc in Canada. The company was rehabilitating an existing mine in southern Quebec, for the production of talc. Reserves were estimated at 4 million tons.

MINERAL FUELS

Coal.—Production of coal came from five Provinces in Canada with Alberta being the largest producer. Canada normally exported more than 45% of the coal it produced and more than 80% of the exports are metallurgical coal. After a decline in 1986, production and consumption both increased. The companies continued to reduce operating costs, improve productivity, and look for new market opportunities. Research continued on technologies that would allow cleaner and more efficient use of coal.

Gulf of Canada Corp. continued development of the Mount Klappan anthracite coal project in northwestern British Columbia. The company shipped test quantities of anthracite to the Republic of Korea and Europe with favorable results. The Mount Klappan Mine could produce about 1.5 million tons annually with estimated reserves of 6 billion tons.

Natural Gas.—Production of natural gas in 1987 was almost the same as in 1986; however, continued price weakness reduced the value of production almost one-quarter. The natural gas industry had a full year of experience with the negotiated pricing of natural gas as opposed to regulated prices. Because of the deregulation of natural gas pricing, Canadian consumers continued to benefit from prices below those available to export buyers. The gap narrowed significantly, however. The National Energy Board (NEB) released a report that predicted 1988 export natural gas volumes may be 21% greater than in 1987. NEB credited the increased sales to the California market. Although Canada has sufficient quantities of natural gas reserves to meet domestic demand, a significant increase in exports could stimulate exploration to develop more reserves.

Petroleum.—Fluctuating oil prices in the international market continued to affect petroleum exploration and development activities in Canada. Several large projects were delayed because of the uncertainty in the marketplace. Amoco Canada Petroleum Ltd. formally made a $5.5 billion bid for Dome Petroleum Ltd. to Dome's sharehold-

ers and creditors by filing the offer with the Court of Queen's Bench. A hearing by the court was set for January 26, 1988. Investment Canada had approved the proposed purchase.

Uranium.—Canada's new policy on foreign ownership specified that Canadians must own at least 51% of an individual uranium property when production begins. The new policy was designed to encourage investment in the uranium mining industry. Canada became the world's largest uranium producer in 1984 and in 1987 accounted for more than one-third of the global output of U_3O_8. The uranium deposits being exploited in Saskatchewan are some of the world's richest. Grades range from 4% to 12% per ton of ore. By comparison, ores being mined at Elliot Lake, Ontario, mines are about 1% per ton of ore.

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[1]For more detailed information on the mineral industry, see the Canadian Mineral Surveys for 1985 and 1986, both of which were prepared by the Mineral Policy Sector and the Energy Sector, Department of Energy, Mines and Resources, Ottawa, Canada. 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, Tucson; University of Arkansas, Fayetteville; California State Library, Sacramento; A. Lakes Library, California School of Mines, Golden; Wilbur Cross Library, University of Connecticut, Storrs; H. M. Morris Library, University of Delaware, Newark; Strozier Library, Florida State Library, 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. Folger Library, University of Maine, Orono; M. S. Eisenhower Library, Johns Hopkins University, Baltimore, MD; Massachusetts Institute of Technology Library, Cambridge; Michigan Technical 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, NJ; New Mexico Institute of Mining and Technology, Socorro; Columbia University, New York, NY; D. H. Hill Library, North Carolina State University, Raleigh; Fritz Library, University of North Dakota, Grand Forks; Ohio State University, Columbus; University of Oklahoma, Norman; Multnomah County Library, Portland, OR; Pennsylvania State University, University Park; University of Rhode Island, Kingston; Thomas Cooper Library, University of South Carolina, 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]Physical scientist, Division of International Minerals.

[3]Where necessary, values have been converted from Canadian dollars (CAN$) to U.S. dollars at the rate of CAN$1.3245=US$1.00.

The Mineral Industry of Chile

By Pablo Velasco[1]

Preliminary data by the Central Bank of Chile indicated that production of copper in the nation set another record high of more than 1.4 million tons in 1987, representing a slight increase over that of 1986 and firmly placing Chile as the world's leading producer and exporter of copper. The growth of Chile's copper industry stems from the high grade of the ore deposits and low production costs.

Income earned from the mining sector's exports amounted to $2.9 billion[2] in 1987, an increase of 26% and representing approximately 58% of the total exports. Copper accounted for $2.2 billion; silver and gold, $304 million. Chile also maintained its rank in the world as the largest producer and exporter of natural crude nitrates (sodium and potassium) and rhenium, 2d in iodine and molybdenum, 3d in lithium, 8th in silver, and 11th in gold. The improvement in mineral prices in the international market, in particular the recovery of world copper prices after a prolonged period of stagnation, had contributed more than $250 million to the value of exports.

Crude petroleum output declined in 1987 because of oilfield depletion in the Strait of Magellan. Domestic oil production supplied about 40% of national consumption. Coal production increased in 1987, reflecting increased demand for steam coal to substitute for fuel oil in thermoelectrical generating plants and the startup of operations at the Cía. de Carbones de Chile Ltda. (COCAR) coal deposit in southern Chile.

The Chilean economy completed its fifth year of economic expansion, well past the recovery phase. The gross domestic product (GDP) grew at a 5.4% rate during 1987, less than the 5.7% rate in 1986, to just above $18.4 billion in terms of current prices. Construction, fishing, transportation, and retail trade accounted for the bulk of the growth. The mining industry was stagnant in 1987 following a 1.5% growth in 1986. Chile was less vulnerable to fluctuations of the world price of copper, traditionally its main export, because of it is less dependent on copper exports. In 1987, copper exports accounted for just 42% of Chile's foreign exchange earnings compared with a 82% share in 1973.

In December 1987, the U.S. Government suspended Chile from eligibility for duty-free entry under the Generalized System of Preferences (GSP) because of Chile's inadequate protection for workers' rights.

The major development in Chile's balance-of-payments outlook in 1987 was the renegotiation in March and April of all medium- and long-term debt to private and foreign government lenders.

The Chilean Government followed cautious monetary and fiscal policies, as required by the economic programs of the International Bank for Reconstruction and Development (World Bank) and the International Monetary Fund. The rate of inflation rose from 17% in 1986 to 22% in 1987.

Government Policies and Programs.—Chile is considered to have an attractive foreign investment law, with liberal capital transfer rules. Of the $1.17 billion in foreign investments that entered the country in 1987, about $497 million corresponded to transactions carried out under Decree Law 600, Chile's foreign investment statute. The remaining $674 million was the result of debt-equity swap operations under chapter XIX of the Central Bank's foreign exchange regulations. In 1986, foreign investments under Decree Law 600 amounted to $184 million, while those under chapter XIX

added $303 million. U.S. firms have been the leaders in taking advantage of Chile's debt-equity swap program. U.S. corporations have bought into Chilean firms to improve their market position in Chile or to convert loans into equity.

Among the most significant projects that materialized in 1987 were the construction of Cape Horn Methanol Ltd.'s $330 million facility near Punta Arenas on the Strait of Magellan, and AMAX Inc.'s formal commitment to invest $300 million in a project in northern Chile that will produce potassium chloride, potassium sulfate, boric acid, and lithium carbonate. Other large approved investments in 1987 were the $400 million ammonia-urea plant in southern Chile and an $8 million contract for petroleum exploration in the Salar de Atacama.

Japan, an important source of investments in Chile, reported through its foreign trade organization that from January 1985 to June 1987, Japanese companies invested $650 million through debt-equity swap transactions. Cominco Resources International Ltd. of Canada and Anglo American Corp. of the Republic of South Africa received approval from their respective boards of directors to begin construction of the Marte gold mine in north-central Chile in early 1988.

The Minister of Mines announced the go-ahead on the La Escondida Mine investment and the funding of major new gold mines. The minister projected that copper output would rise to 2 million tons per year by 1992, when the $1.1 billion Escondida Mine is on-stream and when the current $1.25 billion investment program of the Corporación del Cobre de Chile (CODELCO-Chile) is completed. Also by 1992, gold production in Chile would double, and silver output was expected to increase to about 26 million troy ounces per year.

Privatization of some state enterprises continued throughout the year with sales to private and institutional investors. Companies held by the Corporación de Fomento de la Producción (CORFO) sold shares to their employees.

PRODUCTION

The 16 leading minerals produced in Chile during 1987 were coal, copper, gold, iodine, iron ore, lead, lithium carbonate, manganese, molybdenum, sodium and potassium nitrates, natural gas, crude oil, petroleum products, silver, sodium sulfate, and zinc. Output of eight of these minerals was lower while production rose for the other eight. The production of fine copper increased slightly to 1.41 million tons, more than in 1986, as a result of the mining of higher grades of ore deposits and in response to the recovery of world copper prices. Output of copper's principal byproduct, molybdenum, reached almost 17,000 tons of concentrate, of which 6,200 tons was converted into molybdenum trioxide. The remainder was processed into ferromolybdenum alloy and ammonium perrhenate at Chile's Molibdenos y Metales S.A. (Molymet) plant near Santiago.

CODELCO-Chile accounted for 77% of the country's total copper output and all of the output of molybdenum, which was marketed mainly as a concentrate of molybdenum trioxide. The small- and medium-scale mining sector produced the remaining 23% of the copper.

Among other important mineral commodities, total gold output decreased 5.0% because of decreased output from St. Joe Mineral Co.'s El Indio Mine. State-owned Empresa Nacional de Minería (ENAMI) increased its output of gold almost 12%, while CODELCO-Chile's output was 3.5% lower. Silver production decreased slightly to 16.0 million ounces. Domestic crude oil and natural gas outputs decreased, while production of run-of-mine coal increased by more than 19% owing to increases in demand for fuel oil substitutions in thermoelectrical plants. Production of industrial minerals was higher with the exception of borates, feldspar, sodium and potassium nitrates, and talc.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Arsenic trioxide[e]	--	3,500	4,000	[r]4,000	5,029
Copper:					
Mine output, Cu content[3]	1,255,374	1,307,503	1,359,840	1,399,384	1,412,936
Metal:					
Smelter, primary[4]	1,058,900	1,098,300	1,088,500	1,124,100	[e]1,099,100
Refined:[5]					
Fire, primary refined	[r]153,800	[r]183,000	180,900	185,300	[e]187,900
Electrolytic	[r]680,400	[r]696,700	703,400	757,200	[e]767,600
Total	834,200	879,700	884,300	942,500	[e]955,500
Gold, mine output, Au content ---troy ounces	570,964	541,064	554,278	576,719	547,678
Iron and steel:					
Iron ore and concentrate:					
Gross weight ---------- thousand tons	5,809	6,685	6,534	7,009	6,690
Fe content ---------- do	3,489	3,991	3,967	4,197	4,078
Metal:					
Pig iron ---------- do	540	594	580	591	617
Ferroalloys:					
Ferromanganese ----------	5,209	4,890	6,330	6,277	6,613
Ferrosilicomanganese ----------	--	--	755	1,706	1,231
Ferrosilicon ----------	4,885	6,365	4,501	3,732	4,258
Ferromolybdenum ----------	1,712	2,211	671	1,397	860
Other ----------	--	--	--	--	502
Total ----------	11,806	13,466	12,257	13,112	13,464
Steel, crude[6] ---------- thousand tons	618	692	689	706	720
Semimanufactures (hot-rolled) ---do	371	473	442	481	545
Lead, mine output, Pb content ----------	1,679	4,284	2,473	1,501	829
Manganese ore and concentrate:					
Gross weight ----------	26,050	[r]26,807	35,631	31,631	31,803
Mn content ----------	4,485	[r]8,680	11,865	11,097	10,823
Molybdenum, mine output, Mo content ----------	15,264	16,861	18,389	16,581	16,941
Rhenium, mine output, Re content ---- pounds	12,516	14,198	12,266	18,609	14,471
Selenium ---------- kilograms	43,869	25,450	50,037	47,000	45,909
Silver ---------- thousand troy ounces	15,058	15,766	16,633	16,078	16,068
Zinc, mine output, Zn content ----------	5,993	19,168	22,288	10,504	19,618
INDUSTRIAL MINERALS					
Barite ----------	114,595	21,722	54,494	53,121	52,109
Borates, crude, natural (ulexite) ----------	1,301	3,985	4,773	6,440	13,438
Cement, hydraulic ---------- thousand tons	1,255	1,390	1,430	1,440	1,594
Calcite ---------- do	--	--	--	2,757	2,972
Clays:					
Kaolin ----------	40,812	48,608	48,537	42,170	44,533
Other (unspecified) ----------	31,876	36,543	9,177	14,435	15,975
Diatomite ----------	741	1,712	2,317	2,684	3,218
Feldspar ----------	2,356	3,026	2,565	2,275	705
Gypsum:					
Crude ----------	66,337	167,477	195,911	192,848	235,173
Calcined ----------	53,425	44,818	57,222	60,452	92,441
Iodine, elemental ----------	2,793	[r]2,661	3,020	3,076	3,101
Lapis lazuli ---------- kilograms	--	9,000	8,500	[e]8,000	--
Lime, hydraulic[e] ---------- thousand tons	723	778	800	800	750
Lithium carbonate ----------	--	2,110	4,508	4,458	6,139
Nitrogen: Natural crude nitrates:					
Sodium ----------	472,710	595,360	621,330	617,010	556,240
Potassium ----------	149,800	132,100	150,000	147,100	165,070
Total ----------	622,510	727,460	771,330	764,110	721,310
Phosphates:					
Guano ----------	129	NA	3,150	7,546	5,605
Rock ----------	935	4,606	7,110	6,684	10,389
Total ----------	1,064	4,606	10,260	14,230	15,994
Pigments, mineral, natural: Iron oxide ----------	6,751	16,113	8,224	4,404	8,145
Potash, K_2O equivalent ----------	21,280	18,494	21,000	20,000	[e]20,000
Pumice (includes pozzolan) ----------	173,789	172,150	206,333	222,080	242,453
Quartz, common ----------	221,757	293,465	267,510	293,218	350,488
Salt, all types ----------	714,598	625,760	753,427	1,032,373	865,168
Sodium compounds, n.e.s.: Sulfate[7] ----------	51,300	56,770	52,700	58,700	60,406
Stone:					
Limestone ---------- thousand tons	2,142	2,326	2,470	2,757	3,017
Marble ----------	--	1,440	1,300	--	--

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Sulfur:					
Native, other than Frasch:					
Refined	15,688	13,685	14,755	13,297	14,917
Caliche	83,060	40,279	63,992	43,826	22,131
Byproduct (from industrial gases)	32,364	32,135	30,073	41,142	334,100
Total	131,112	86,099	108,820	98,265	371,148
Talc	637	422	1,299	2,257	980
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous and lignite thousand tons	1,095	1,323	1,384	1,454	1,736
Coke: Coke oven do	279	278	291	294	297
Gas, natural:					
Gross million cubic feet	169,609	[r]172,971	163,790	153,866	153,725
Marketed do	52,760	53,431	50,535	42,342	40,448
Natural gas liquids:					
Natural gasoline thousand 42-gallon barrels	937	962	945	893	895
Liquefied petroleum gas do	2,855	[r]2,956	2,916	2,716	2,760
Total do	3,792	[r]3,918	3,861	3,609	3,655
Petroleum:					
Crude do	14,365	14,069	13,048	12,204	10,922
Refinery products:					
Gasoline:					
Aviation thousand 42-gallon barrels	94	56	25	82	51
Motor do	8,032	8,233	8,246	7,793	9,000
Jet fuel do	1,126	[r]1,264	1,195	1,372	1,617
Kerosene do	1,164	[r]855	755	969	1,069
Distillate fuel oil do	7,334	8,064	8,749	9,661	10,611
Residual fuel oil do	6,390	5,982	5,566	5,642	5,466
Liquefied petroleum gas do	2,208	5,114	4,831	5,044	5,334
Unspecified do	1,252	1,453	1,554	1,566	1,377
Total do	27,600	31,021	30,921	32,129	34,525

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

[1]Table includes data available through Aug. 1988.

[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 nonduplicate copper content of ore, concentrates, cemented copper, slags and minerals, copper as a byproduct of gold and silver precipitate, and other copper-bearing products measured at the last stage of processing as reported in available sources.

[4]Figures are total blister, fire-refined, electrolytic, and equivalent copper output including that blister subsequently refined in Chile and copper produced by electrowinning. Detailed statistics on electrowinning are not available; although based on current plant capacities, electrowon copper production is estimated to be approximately 55 metric tons per year.

[5]Figures are total refined copper distributed into two classes according to method of refining, fire-refined and electrolytic, which includes electrowon copper refined in Chile.

[6]Excludes castings.

[7]Includes natural sodium sulfate and anhydrous sodium sulfate, coproducts of the nitrate industry.

TRADE

The total value of mineral exports in 1987 was $2.9 billion, 26% higher than in 1986. Minerals represented approximately 58% of the country's total exports: copper, $2.2 billion; gold and silver, $304 million; iron ore, $101 million; molybdenum, $100 million; nitrates and iodine, $99 million; and other mineral products, $89 million. Improved copper prices accounted for $330 million of the value of exports. For the year as a whole, the average price of copper rose to 81 cents per pound, peaking at an average for December of $1.30 per pound. World prices for iodine also rose significantly. As the world's largest producer of primary copper, Chile supplied the world metal market with approximately 1.2 million tons of fine copper contained in a number of products. The amount represents nearly 15% of Western World copper consumption.

Of the total copper exported, 1.09 million tons was produced by CODELCO-Chile, and the remainder was sold by private companies. Of the copper exported, 55% was electrolytic copper in the form of wirebars and cathodes; 14% was fire-refined copper;

15% was blister copper, and the remaining 16% was copper contained in concentrates. Earnings from copper exports totaled $1.9 billion, about $460 million more than in 1986.

CODELCO-Chile shipments of molybdenum in 1987 amounted to about 18,000 tons of contained molybdenum for a value of $120 million. This compares with shipments of 19,408 tons of contained molybdenum valued at $125 million in 1986. Shipments by CODELCO-Chile of other byproducts were valued at $87 million, an increase of $46 million compared with those of 1986.

Table 2.—Chile: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Unwrought	57	147	--	All to Japan.
Semimanufactures	17	22	--	Bolivia 11; Uruguay 5; Ecuador 3.
Copper:[2]				
Ore and concentrate thousand tons	6,124	20,796	25	Brazil 9,352; Japan 5,970; Canada 2,017.
Matte and speiss including cement copper	420	--		
Metal including alloys:				
Scrap	187,206	206,029	28,691	Turkey 27,807; West Germany 22,173.
Unwrought	894,339	924,979	161,519	West Germany 138,303; Italy 112,210.
Semimanufactures	11,725	14,096	2,833	Colombia 6,433; Ecuador 1,419.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	6,082	4,666	108	Japan 4,506; Mexico 52.
Pyrite, roasted value, thousands	--	$1	--	All to France.
Metal:				
Scrap	2,502	17,013	--	Peru 5,455; Bolivia 360; unspecified 11,198.
Ferroalloys:				
Ferromanganese	404	220	--	Peru 100; Ecuador 80; Colombia 40.
Unspecified	3,272	5,243	932	Belgium-Luxembourg 1,542; Peru 890.
Steel, primary forms	79,174	88,594	24	Ecuador 43,754; Costa Rica 31,692; Guatemala 11,512.
Semimanufactures:				
Bars, rods, angles, shapes, sections	11,052	11,679	--	El Salvador 5,044; Ecuador 3,906; Honduras 1,558.
Universals, plates, sheets	14,577	23,063	--	Costa Rica 7,944; Ecuador 6,460; Guatemala 5,743.
Hoop and strip	7	32	--	Peru 31; Iraq 1.
Wire	800	726	535	Peru 143; Bolivia 35.
Tubes, pipes, fittings	265	49	16	Iraq 24; Bolivia 7.
Castings and forgings, rough	18	71	7	Panama 42; Dominican Republic 20.
Lead:				
Ore and concentrate	2,266	3,132	1,984	Belgium-Luxembourg 1,148.
Metal including alloys, semimanufactures	16	--		
Molybdenum: Ore and concentrate, Mo content	5,523	6,115	--	Netherlands 2,915; Canada 1,294; West Germany 881.
Nickel: Matte and speiss	11	3	--	All to West Germany.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, platinum value, thousands	$27	$290	$258	United Kingdom $32.
Silver:				
Ore and concentrate[3] do.	$56,677	$84,304	--	Japan $43,090; Sweden $15,697; West Germany $15,232.
Waste and sweepings[3] do.	$18	$61	--	Belgium-Luxembourg $33; United Kingdom $28.
Metal including alloys, unwrought and partly wrought	$67,200	$68,214	$33,726	West Germany $10,154; United Kingdom $8,784.
Zinc:				
Ore and concentrate	36,809	43,322	--	Japan 24,648; Republic of Korea 7,449; Belgium-Luxembourg 6,131.
Metal including alloys:				
Scrap	45	(4)	--	All to Iraq.
Semimanufactures	--	1	--	All to Guatemala.

See footnotes at end of table.

Table 2.—Chile: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Other:				
Ores and concentrates	34,871	29,246	1,964	United Kingdom 9,656; Japan 4,956; Netherlands 3,325.
Ashes and residues	3	7,180	5	Belgium-Luxembourg 7,175.
Base metals including alloys, all forms	4	--		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Artificial corundum	10	--		
Grinding and polishing wheels and stones	--	1	NA	NA.
Asbestos, crude	--	20	--	All to Uruguay.
Barite and witherite	68,828	26,843	26,843	
Boron materials: Crude natural borates	--	4,743	4,493	Brazil 200; Colombia 50.
Cement	--	2,750	--	All to New Caledonia.
Chalk	--	30	--	Bolivia 20; Argentina 10.
Diamond: Gem, not set or strung value, thousands	$13	$14	$6	West Germany $3; Thailand $2.
Diatomite and other infusorial earth	432	614	--	Argentina 560; Peru 29; Brazil 19.
Fertilizer materials:				
Crude, n.e.s	--	165	--	West Germany 100; Bolivia 60; unspecified 5.
Manufactured:				
Ammonia	--	1	--	All to Peru.
Nitrogenous	4,393	4,501	--	Colombia 2,950; Argentina 1,125; Bolivia 211.
Phosphatic	--	54	--	Argentina 50; Bolivia 4.
Unspecified and mixed	113,210	108,315	18,375	Brazil 77,985; Belgium-Luxembourg 3,530.
Gypsum and plaster	--	33	--	All to New Caledonia.
Nitrates, crude	327,011	361,909	96,009	Belgium-Luxembourg 103,357; China 88,466.
Phosphates, crude	10	84	--	All to Ecuador.
Pigments, mineral: Iron oxides and hydroxides, processed	--	20	--	Do.
Precious and semiprecious stones other than diamond, natural value, thousands	$13	$5	--	All to Spain.
Salt and brine	517,117	921,244	488,962	Brazil 256,999; Canada 109,277.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	--	115	--	Bolivia 104; Peru 6; Paraguay 5.
Sulfate, manufactured	40,064	31,421	20	Brazil 15,277; New Zealand 5,200; Venezuela 3,850.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	18	--		
Worked	--	45	43	Argentina 2.
Quartz and quartzite	94	(4)	--	All to West Germany.
Sulfuric acid	15	15	--	All to Bolivia.
Other:				
Crude	--	160	--	Uruguay 110; Brazil 50.
Slag and dross, not metal-bearing	--	96,534	--	All to Japan.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	--	16	--	Bolivia 10; Ecuador 6.
Coal:				
Lignite including briquets	--	3	--	All to Bolivia.
All grades excluding briquets	--	140	--	Do.
Coke and semicoke	34,362	12,229	--	All to Belgium-Luxembourg.
Petroleum:				
Crude—42-gallon barrels	--	202	--	Argentina 194; Ecuador 8.
Refinery products:				
Mineral jelly and wax —do	8	150	--	All to Spain.
Kerosene and jet fuel—do	271,157	5,634	--	Panama 5,247; Bolivia 387.
Distillate fuel oil —do	3,118	1,641	--	United Kingdom 276; unspecified 1,365.
Lubricants —do	12,096	104,237	--	Peru 85,547; Uruguay 17,136; Paraguay 945.
Nonlubricating oils—do	112	49	--	Uruguay 28; Bolivia 21.
Residual fuel oil—do	393	3,117	--	United Kingdom 1,039; unspecified 2,078.
Petroleum coke —do	55	270	--	All to Bolivia.

NA Not available.
[1]Table prepared by H. D. Willis.
[2]Previously reported copper data were from separate sources using different reporting techniques.
[3]May include other precious metals.
[4]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and rare-earth metals	19	43	(2)	China 23; Algeria 5; U.S.S.R. 5.
Aluminum:				
Ore and concentrate	2,489	2,251	--	Mainly from Guyana.
Oxides and hydroxides	532	471	323	Japan 59; Netherlands 40.
Metal including alloys:				
Scrap	1,848	3,420	6	Venezuela 1,493; Canada 1,041; Argentina 738.
Unwrought	--	20	20	
Semimanufactures	2,489	2,813	359	Brazil 892; West Germany 885.
Chromium:				
Ore and concentrate	4,506	4,490	--	Turkey 2,090; New Caledonia 1,482; Republic of South Africa 551.
Oxides and hydroxides	103	107	7	Brazil 47; West Germany 28; Argentina 13.
Cobalt: Oxides and hydroxides	30	9	7	Belgium-Luxembourg 2.
Columbium and tantalum: Metal including alloys, all forms, tantalum value, thousands	$17	--		
Copper:				
Ore and concentrate	17	--		
Metal including alloys:				
Scrap value, thousands	$55	--		
Unwrought	6	7	3	United Kingdom 4.
Semimanufactures	271	504	78	Brazil 196; Republic of Korea 87.
Iron and steel:				
Iron ore and concentrate: Pyrite, roasted	17	10	5	Japan 5.
Metal:				
Scrap	5,200	81	18	Republic of South Africa 61; West Germany 2.
Pig iron, cast iron, related materials	1,391	500	23	West Germany 320; Brazil 120; Argentina 25.
Ferroalloys:				
Ferromanganese	436	627	1	Brazil 346; France 120; Republic of South Africa 75.
Unspecified	1,795	1,482	55	Republic of South Africa 841; West Germany 201; Sweden 158.
Steel, primary forms	15,670	35,727	993	Republic of South Africa 14,597; Brazil 6,020; West Germany 3,966.
Semimanufactures:				
Bars, rods, angles, shapes, sections	61,641	87,806	225	Argentina 33,166; Republic of South Africa 12,425; Brazil 12,224.
Universals, plates, sheets	19,879	39,757	97	Brazil 9,279; Japan 8,183; United Kingdom 8,101.
Hoop and strip	1,709	1,944	36	Brazil 797; United Kingdom 482; West Germany 433.
Rails and accessories	2,775	4,038	2,647	United Kingdom 530; Republic of South Africa 352.
Wire	1,430	1,636	31	Brazil 637; Japan 467; Republic of South Africa 155.
Tubes, pipes, fittings	5,202	6,555	533	Brazil 1,907; Japan 1,196; West Germany 614.
Castings and forgings, rough	4,389	5,253	871	Belgium-Luxembourg 1,791; Brazil 903.
Lead:				
Oxides	182	157	2	Peru 104; Republic of South Africa 51.
Metal including alloys:				
Scrap	1,232	1,541	71	Peru 1,267; Mexico 150.
Unwrought	236	55	55	
Semimanufactures	16	220	6	United Kingdom 121; West Germany 88.
Magnesium: Metal including alloys:				
Unwrought	--	1	1	
Semimanufactures	23	5	2	West Germany 3.
Manganese: Oxides	39	56	33	Belgium-Luxembourg 13; Netherlands 10.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Molybdenum: Metal including alloys, all forms ____ value, thousands__	$20	$34	--	Austria $19; Belgium-Luxembourg $13; United Kingdom $2.
Nickel:				
Matte and speiss ____	75	307	10	Canada 173; U.S.S.R. 68; Norway 37.
Metal including alloys, semimanufactures ____	64	92	11	Austria 32; Netherlands 20.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, platinum value, thousands__	$13	$36	$14	West Germany $19; Switzerland $3.
Silver:				
Ore and concentrate[3] ____ do____	--	$5	--	All from Greece.
Metal including alloys, unwrought and partly wrought ____ do____	$95	$131	$21	West Germany $73; Italy $15.
Tin:				
Ore and concentrate ____	8	--		
Metal including alloys:				
Scrap ____	296	333	12	Bolivia 149; Malaysia 72; United Kingdom 54.
Semimanufactures ____	5	14	([2])	Bolivia 8; United Kingdom 2; Brazil 1.
Titanium: Oxides ____	301	402	7	United Kingdom 342; Belgium-Luxembourg 29; Republic of South Africa 10.
Tungsten: Metal including alloys, all forms ____ value, thousands__	$22	$20	$17	Brazil $1; Japan $1.
Uranium and thorium: Metal including alloys, all forms ____ do____	$91	$85	$8	West Germany $20; Sweden $17; Bolivia $16.
Zinc:				
Oxides ____	149	156	--	Peru 66; Argentina 55; Netherlands 23.
Metal including alloys:				
Scrap ____	5,963	5,630	--	Peru 4,710; Canada 400; Netherlands 300.
Unwrought ____	73	131	--	Peru 127; Belgium-Luxembourg 4.
Semimanufactures ____	170	195	3	United Kingdom 94; Belgium-Luxembourg 31; Republic of South Africa 28.
Other:				
Ores and concentrates ____	209	5,222	--	United Kingdom 5,000; Republic of South Africa 139; Australia 82.
Oxides and hydroxides ____	17	15	9	West Germany 5.
Base metals including alloys, all forms	45	112	2	Republic of South Africa 50; United Kingdom 42; Netherlands 11.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc ____	73	78	29	West Germany 48.
Artificial corundum ____	994	1,250	6	United Kingdom 720; West Germany 349; Brazil 110.
Dust and powder of precious and semiprecious stones value, thousands__	$13	$19	$14	Spain $4; West Germany $1.
Grinding and polishing wheels and stones ____	470	646	12	Brazil 210; West Germany 139; Switzerland 107.
Asbestos, crude ____	8,387	38,915	403	Canada 38,026; Italy 271.
Barite and witherite ____	1	8	--	All from Peru.
Boron materials:				
Crude natural borates ____	290	--		
Oxides and acids ____	15	21	2	West Germany 12; France 6.
Cement ____	4,437	8,228	1	Argentina 5,871; France 903; Brazil 699.
Chalk ____	70	163	160	Brazil 3.
Clays, crude ____	533,414	14,419	9,821	Peru 2,570; Argentina 1,811.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Diamond:				
Gem, not set or strung value, thousands	$16	$1	--	All from Brazil.
Industrial stones do	$409	$323	$280	Republic of South Africa $42; Italy $1.
Diatomite and other infusorial earth	70	53	--	All from Mexico.
Feldspar, fluorspar, related materials	21,291	290	--	Republic of South Africa 197; Argentina 73; United Kingdom 20.
Fertilizer materials: Manufactured:				
Ammonia	17,853	23,913	1	Venezuela 23,908; West Germany 3.
Nitrogenous	106,593	163,091	125,968	Venezuela 33,045; Netherlands 1,961.
Phosphatic	141,426	152,097	152,096	Canada 1.
Potassic	19,900	26,377	26,369	Canada 7; West Germany 1.
Unspecified and mixed	62,601	67,126	66,559	Netherlands 393; United Kingdom 82.
Graphite, natural	4,049	166	3	Canada 100; Peru 36; West Germany 16.
Gypsum and plaster	--	2	--	Argentina 1; France 1.
Lime	3,866	6,799	--	All from Argentina.
Magnesite, crude	59,461	37,285	30,676	Brazil 3,311; United Kingdom 2,010.
Mica:				
Crude including splittings and waste	2,751	50	16	Argentina 17; India 17.
Worked including agglomerated splittings	5	6	1	India 2; Spain 1.
Nitrates, crude	2,667	80	--	All from Venezuela.
Phosphates, crude	18,948	13,871	13,871	
Pigments, mineral: Iron oxides and hydroxides, processed	107	122	3	West Germany 63; Brazil 54.
Potassium salts, crude	28,329	53,506	--	Canada 53,494; West Germany 12.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$2	$5	--	Switzerland $3; Belgium-Luxembourg $2.
Synthetic do	$9	$7	$7	
Pyrite, unroasted	--	5	--	Switzerland 4; West Germany 1.
Salt and brine	2,088	3,256	41	West Germany 3,061; Netherlands 130.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	47,736	57,496	42,072	France 11,324; Kenya 1,996.
Sulfate, manufactured	231	358	25	Argentina 143; West Germany 97; Mexico 56.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	394	221	1	Italy 212; Bolivia 7.
Worked	402	278	9	Spain 155; Italy 58; West Germany 31.
Dolomite, chiefly refractory-grade	14,776	17,625	17,067	Argentina 473; Spain 70.
Gravel and crushed rock value, thousands	$1	--	--	
Quartz and quartzite	--	251	--	Spain 162; Brazil 66; Netherlands 13.
Sand other than metal-bearing	314	25,332	568	Argentina 24,740; Italy 18.
Sulfur:				
Elemental:				
Crude including native and by-product	77,338	65,121	3,916	Canada 41,392; Bolivia 19,783.
Colloidal, precipitated, sublimed	119	65	65	
Sulfuric acid	18,372	35,705	7	Peru 34,515; West Germany 7.
Talc, steatite, soapstone, pyrophyllite	1,580	11,044	527	Finland 10,030; Italy 248.
Other:				
Crude	5,111	1,111	718	Mexico 125; United Kingdom 95.
Slag and dross, not metal-bearing	50	109	25	United Kingdom 84.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	670	815	15	Argentina 500; Trinidad and Tobago 300.
Carbon black	5,273	5,067	382	Venezuela 3,393; Colombia 975.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coal:				
Lignite including briquets	1,049	2	2	
All grades excluding briquets	370,950	487,616	106,515	Australia 232,640; Canada 148,347.
Coke and semicoke	58,802	56,482	--	All from Japan.
Peat including briquets and litter	20	13	--	Canada 10; Ireland 2.
Petroleum:				
Crude thousand 42-gallon barrels	15,157	19,859	3	Venezuela 6,998; Nigeria 5,335; Ecuador 2,741.
Refinery products:				
Liquefied petroleum gas do	(2)	149	(2)	Mainly from Venezuela.
Gasoline, motor do	100	1,004	101	Netherlands Antilles 868; Panama 34.
Mineral jelly and wax do	53	69	2	Brazil 24; Argentina 22; West Germany 10.
Kerosene and jet fuel do	38	122	(2)	Netherlands Antilles 118; Argentina 4.
Distillate fuel oil do	336	1,596	297	Netherlands Antilles 1,272; Panama 27.
Lubricants do	447	491	181	Venezuela 127; Netherlands 110.
Nonlubricating oils do	16	12	7	Venezuela 2; United Kingdom 1.
Residual fuel oil do	120	159	--	Panama 75; Netherlands Antilles 53; Peru 31.
Bitumen and other residues do	31	31	2	Argentina 29.
Bituminous mixtures 42-gallon barrels	1,048	545	339	West Germany 188; Brazil 18.
Petroleum coke do	1,111	644	88	Argentina 550; Brazil 6.

[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]May include other precious metals.

COMMODITY REVIEW

METALS

Copper.—Chile continued as the leading producer and exporter of copper in the world. Copper earned more than 42% of Chile's total export revenues and remained the principal export commodity. Chile produces about 22% of the copper produced by the market economy countries. Chilean copper producers have low production costs resulting from relatively high ore grades and economies of scale, as well as lower labor and environmental control costs. Proven and probable reserves are in excess of 100 million tons of contained copper. In 1987, export shipments of copper declined slightly to 1.36 million tons. Nevertheless, copper revenues jumped 27% to $2.23 billion, reflecting the rise in copper prices to more than $1.00 per pound during the second half of 1987.

CODELCO-Chile, the largest copper producer in the world, continued as the country's dominant copper producer with 77% of total national output, a slight decrease below that of 1986. Privately owned mines, which accounted for the rest of the output, produced 21% more copper than in 1986.

CODELCO-Chile invested $323 million in equipment and installation projects in 1987. The following were the most important expenditures: at the Chuquicamata Div.—increasing ore beneficiation capacity to 153,000 tons per day, leaching of waste dumps, and improvements to electrolytic refinery No. 2 and to the pier and coal-handling system for the Tocopilla powerplant; at the Salvador Div.—expansion of the Chañaral mechanized port facility and El Hueso gold mining project, and modernization of the Potrerillos smelter; at the El Teniente Div.—expansion of smelter capacity; and at the Andina Div.—increasing the retaining wall capacity of the Los Leones tailings disposal dam by 630,000 cubic meters to 35 million cubic meters.

Costs of environmental protection and pollution control amounted to $80 million at the four operating divisions of CODELCO-Chile in 1987. Sulfurous fumes at the Chu-

quicamata smelter were curtailed by converting them into sulfuric acid. The control system was commissioned in 1987 with an initial output of 700 tons per day of sulfuric acid. After expansion of the acid plant in 1988, acid production will increase to 2,400 tons per day.

ENAMI's production of refined copper was more than 200,000 tons in 1987, exceeding 1986 production by 14%. ENAMI also produced 8.6 million ounces of silver, and 274,600 ounces of gold, increases of 37% and 12%, respectively, from 1986 levels. Both metals were recovered from residues of the electrolytic process.

In the small- and medium-scale mining sector, Cía. Minera Disputada de las Condes S.A., a subsidiary of Exxon Minerals Chile Inc., operated two mines, two concentrators and one smelter. El Soldado Mine supplied copper ore to El Cobre concentrator in the coastal area near Santiago, and the Los Bronces Mine supplied the San Francisco concentrator in the Andes Mountains east of Santiago. Part of the company's copper concentrate was smelted at its Chagres smelter to produce about 40,000 tons per year of blister copper and 80,000 tons per year of sulfuric acid. Producing nearly 93,000 tons of copper in 1987, Minera Disputada became the largest private copper company in Chile. The second largest private copper producer was Mantos Blancos Mine, owned by Anglo American and located 45 kilometers from Antofagasta. This company, which produced about 86,000 tons of copper in 1987, has invested $70 million in a major expansion of its mine and added a sulfide ore flotation plant. Oxide copper ore leach capacity is 9,500 tons per day. The cement copper produced is smelted and sold as fire-refined copper; the sulfide ore is processed by conventional crushing and grinding, followed by flotation to produce copper concentrate that was sold to ENAMI. Silver was an important byproduct.

Sociedad Minera Pudahuel S.A. operated two mines, Lo Aguirre near Santiago and Las Cascadas near the port of Iquique. The combined copper production from these mines in 1987 was 30,900 tons.

Cía. Minera Cerro Centinela S.A., owned by the LUKSIC Group, operated the Carolina de Michilla, Cerro Negro, Santa Margarita de Astillas, Combarbalá, and Illapél Mines to produce about 24,000 tons of copper per year and 322,000 ounces of silver plus a minor amount of gold.

Cía. Minera Ojos del Salado, wholly owned by Phelps Dodge Corp. of the United States, expanded its concentrator plant capacity from 14,500 tons per year to 22,000 tons per year of copper concentrate grading 30% copper, 1.6 ounces of silver per ton, and 0.2 troy ounce of gold per ton. All production was sold to ENAMI.

A consortium of foreign investors, led by BHP-Utah Mineral International Inc., was negotiating an agreement with the Chilean Foreign Investment Committee under article 600 of the Chilean Investment Law for the development and exploitation of La Escondida copper mining project. The enterprise would be one of the largest mining project in the world, with an estimated investment of $1.1 billion over a 3-year period. The partners, who will provide about $400 million in capital investment, are as follows: Utah International Inc., wholly owned subsidiary of the Australian firm The Broken Hill Pty. Co. Ltd. (BHP), 60%; Rio Tinto Zinc Corp. PLC (United Kingdom), 30%; and Mitsubishi Corp., Mitsubishi Metal Corp., and Nippon Mining Co., through Japan Escondida Co., 10%. The balance of approximately $680 million will be financed by a group of investors and banks. These include the Export-Import Bank of Japan, $245 million; a group of Japanese commercial banks, $105 million; the Kreditanstalt für Wiederaufbau, $140 million; the Export Development Corp. of Canada, $50 million; Kansallis-Osake-Pankki of Finland, $46 million; the World Bank, $70 million; and an "export finance" group, $24 million. Since 1981, about $90 million has been invested in the project for exploration activities.

Five engineering firms have shown interest in bidding for the engineering and construction of facilities for La Escondida project. Bids were to be opened on April 11, 1988, and the contract awarded by the end of April 1988. The entire project was to be completed within 3 years.

According to the loan agreements, about 90% of total copper production must be available to foreign buyers by the end of 1991. Sales agreements for 6.2 million tons of copper concentrate have been announced. The buyers include seven Japanese smelters who are partners in the mine and will purchase 4.3 million tons of copper concentrate over a 12-year period starting in 1991; and various customers in the Federal Republic of Germany and Finland who are putting up some of the investment capital and will buy 1.9 million tons.

La Escondida, in the Atacama Desert, has one of the largest copper reserves in the world. Economically recoverable reserves are estimated at 675 million tons with an average grade of 2.16% copper. The deposit also has residual gold, silver, and molybdenum.

When the mine is fully developed, La Escondida's output of 320,000 tons per year of copper concentrate would make it the world's third largest copper mine, after Chuquicamata at 520,000 tons per year and El Teniente at 370,000 tons per year. La Escondida is potentially one of the most significant copper projects for the 1990's and is destined to keep Chile as the world's biggest and lowest cost producer of copper well into the next century.

Gold and Silver.—Chile's preliminary figures indicate that gold production decreased by 5% to about 548,000 ounces, primarily because of decreased output from El Indio Mine. Silver output was unchanged at about 16 million ounces in 1987. Gold and silver were produced primarily as byproducts of copper operations.

ENAMI, the state-owned marketing and processing agency for small- and medium-size mines, operated a precious metals refinery at Las Ventanas to recover gold and silver from residues of electrowon copper. ENAMI also purchased gold ore from the small mining sector and processed concentrate from CODELCO-Chile on a toll basis. ENAMI produced 52% of the total gold output of the country, or about 276,000 ounces, an increase of 12% over that of 1986. Gold output from El Indio Mine continued its downward trend since 1985 owing to exhaustion and falling grades. Gold output was 211,000 ounces, down 19%. CODELCO-Chile gold output also decreased slightly.

Exploration for precious metals in Chile continued to intensify owing to the improved gold and silver prices in recent years and to favorable debt-equity swap operations.

On November 2, 1987, St. Joe Gold Corp., a former subsidiary of Fluor Corp., was bought by Dallhold Resources Inc., a subsidiary of the Alan Bond Group of companies in Australia. In addition to El Indio Mine, St. Joe Gold operated El Tambo Mine, 8 kilometers southeast of El Indio. Underground and surface mining had begun in 1985 at El Indio while heap leaching of low-grade gold ores was begun in September 1986 at El Tambo.

The heap-leaching operation at El Tambo Mine had a design capacity of 15,000 tons per month but it actually processed only 10,000 tons per month. Gold recovery was approximately 50% after 60 days and 73% after 150 days. The new Australian owners planned to increase the production capacity of El Indio and Tambo Mines from 62,500 tons of ore per month to 90,000 tons in 1988 and 1989. The recovered gold was sent to El Indio metallurgical plant.

At the Marte gold project in the desert zone of Copiapó south of the Salar de Maricunga, Cominco Resources and Anglo American have invested $30 million in exploration drilling and sampling and built nearly 420 kilometers of access road. With an additional investment of $47 million, the joint venture expected to have the property in production by the end of 1989 at the rate of about 90,000 ounces of gold per year. The estimated reserves were 39.6 million tons of ore grading 0.04 ounce of gold per ton. A surface mining and heap-leaching operation initially would process about 2 million tons per year of ore. The open pit would have a low waste-to-ore stripping ratio.

Gold Fields Mining Inc., a wholly owned subsidiary of Consolidated Gold Fields PLC, sold its Coipa silver-gold deposit in Chile for $30 million and future royalty entitlement. The buyer was Cía. National de Mineria Ltda. (CNM), a Chilean company. Consolidated TVX Mining Inc., a Canadian private company with interests in Brazil, was to acquire a 49% interest in CNM.

Only 6 kilometers south of Marte, Anglo American was drilling in El Lobo, a deposit that had an estimated 30 million tons of ore grading 0.04 ounce of gold per ton. This property also could be in operation by 1990 or 1991.

El Hueso was another project near El Salar de Maricunga that has been explored by El Salvador Div. of CODELCO-Chile. Reportedly, more than $20 million had been invested in development and metallurgical testing. The ore body was amenable to surface mining and heap leaching. Reserves were estimated at 16 million tons of ore grading 0.05 ounce of gold per ton and 22.5 ounce of silver per ton. Homestake Mining Co. of the United States bought the property for $50.4 million despite labor union opposition to its privatization.

Construction was scheduled to begin in October at the new Choquelimpie silver-gold mining project in northern Chile. The project was a joint venture of Westfield Minerals, Shell Chile S.A., and Citibank

N.A. The deposit is 15,200 feet above sea level in the Parinacota District, close to the Bolivian border, and is accessible by road from Arica. Development and operation of the mine will be by a Cía. Minera Altiplano, a separate company created by the partners. Measured reserves include both oxide and sulfide ores, estimated at 12 million tons grading 0.07 ounce of gold per ton and 1.9 ounce of silver per ton. Estimated production would be 50,000 ounces of gold in the first year of operation, rising to 100,000 ounces in the third year. Full-scale operation was expected to begin in mid-1988 with a mine life of up to 10 years.

The value of silver exports increased 18% to $80 million owing chiefly to increased silver prices during the year. Of the total of 16 million ounces, ENAMI produced 8.6 million ounces of silver at its Las Ventanas precious metals refinery, from concentrate purchased from small- and medium-size mines. The most important silver mines were Caracoles, Cachinal de la Sierra, El Bronce, and Vaquillas. CODELCO-Chile produced 7.1 million ounces of silver, or about 44% of the nation's total. CODELCO-Chile recovered silver from anode slimes at the Chuquicamata and El Salvador copper refineries.

Iron Ore.—Production of iron ore decreased 4.6% to a gross weight of 6.7 million tons. Cía. Minera del Pacífico S.A. (CMP) operated iron mines in the northern part of the country. The operation was oriented basically toward exports; overseas shipments accounted for about 84% of the total sales in 1987. CMP's production capacity was 7.5 million tons per year of products comprising sinterfines, lump ore, and pellets. In 1987, the company made some adjustments in its operations in order to accommodate the volume and quality requirements of the international market. CMP produced 6 million tons in 1987, of which 60% was iron ore pellets. Iron ore and pellets were exported mostly to Japan followed by the United States, the Federal Republic of Germany, and Argentina. The value of iron ore and pellets exported increased 9% to $96 million. CMP's domestic shipments of about 1 million tons were destined for the Huachipato steel plant near Conception. CMP obtained a net profit of $464,000 in 1987 compared to a loss of $4.5 million in 1986. CMP's iron ore mines had about 350 million tons of reserves.

Iron and Steel.—The recently privatized holding company, Cía. Aceros del Pacífico S.A. (CAP), produced pig iron, crude steel, and ferroalloys at about the same levels as in 1986, while its output of semimanufactured (controlled) products increased by 13%. Cía. Siderúrgica de Huachipato S.A. (CSH), a subsidiary of CAP, earned $26 million in 1987, up 52%, the largest profit ever made by CSH in its history. Almost 82% of total production was consumed domestically, and the balance was exported to Ecuador and Costa Rica.

In December 1986, CORFO sold 3% of its shares of CAP to CAP employees, with the result that the private sector held 52% and the workers held 24% of the total capital. Subsequently, CORFO sold to the private sector the remainder of its CAP shares.

In September, CORFO signed an agreement with the consortium Mitsubishi-Nippon Kokan K.K. for the construction of a new 500,000-ton-per-year coke plant that would be financed entirely with foreign credit. The investment required was estimated at $110 million and the plant was expected to be operational in the next 3-1/2 years.

Lead and Zinc.—Chile was a minor producer of lead and zinc ores. In 1987, the output of lead declined by 45% while the production of zinc rose 87%. Of three producers of these commodities in Chile, the most important one was Sociedad Contractural Minera El Toqui Ltda. All of them were in Aysén Province, southern Chile. The other two lead and zinc producers were Cía. Minera Catemo Ltda. and Empresa Minera de Aysén Ltda., owned by CORFO. Minera Catemo operated a 700-ton-per-day floatation concentrator, producing about 2,000 tons per year of lead concentrate and 9,000 tons per year of zinc concentrate.

Minera El Toqui, initiated in 1984, resumed operation in 1987 after being shut down for most of 1986 owing to falling lead and zinc prices and heavy debt servicing costs of about $30 million. The company's debt was restructured, and the mine reopened in October. The Government provided the firm with assistance because it was one of few employers in this remote southern area. Nonetheless, the firm was forced to reduce the labor force by one-half in November, Lac Minerals Ltd. of Canada paid $19 million for 85% control of the company through a debt-equity swap. Minera El Toqui was treating 650 tons per day of lead and zinc ores from the San Antonio zinc mine and was planning to increase production to 1,100 tons of ore per day. Lac

Minerals will invest an additional $6 million during the next 3 years in exploration and development of the Katerfeld II polymetallic vein. The deposit has at least 100,000 tons of ore grading 0.96 ounce of gold per ton.

Molybdenum.—CODELCO-Chile was the second largest producer of molybdenum in the world and the only producer in Chile. Copper deposits in Chile contain 25% of the world's known molybdenum reserves and 37% of the known rhenium reserves. In 1987, CODELCO-Chile produced almost 17,000 tons of molybdenum in concentrates. Of this amount, 6,202 tons was converted into molybdenum trioxide in Chuquicamata and the rest was sent to Molymet in Santiago for processing into molybdenum trioxide, ferromolybdenum alloy, and ammonium perrhenate.

On December 23, the U.S. Government removed molybdenum ores and oxides from duty-free eligibility under the GSP. This action followed a petition by domestic producers of molybdenum ore and oxide. As a consequence, the duty to be applied to Chile was that of the most-favored-nation tariff rate: 9 cents per pound on the molybdenum content and 6 cents per pound on the molybdenum content of the oxides, plus 1.9% ad valorem.

The new tariff went into effect for all beneficiary developing countries 2 days after the appearance of the Government's proclamation. The U.S. Government decision was based on the troubled condition of the domestic industry and the administration's longstanding policy that GSP's are temporary and should be removed when beneficiaries no longer need the preferences to gain access to the U.S. market.

Rhenium.—Molymet was the sole producer of ammonium perrhenate in Chile. It was recovered by a solvent extraction process from gases produced from the roasting of molybdenum concentrate. Production of rhenium in 1987 decreased 22% to 14,471 pounds. The ammonium perrhenate price increased 52% to $393 per kilogram.

INDUSTRIAL MINERALS

Lithium and Potassium.—Sociedad Chilena de Litio Ltda., jointly owned by Foote Mineral Co. (55%) of the United States and CORFO (45%), produced almost 6,200 tons of lithium carbonate in 1987, an increase of 38%. The production plant, with a capacity of about 14 million pounds per year of lithium carbonate, came on-stream in the second half of 1984 at capital cost of $56 million.

Sociedad Minera Salar de Atacama Ltda. (MINSAL), a consortium of AMAX, 63.75%; CORFO, 25%; and Molymet, 11.25%, had a contract with the Chilean Government to produce potassium chloride, 500,000 tons per year; potassium sulfate, 250,000 tons per year; boric acid 30,000 tons per year, and lithium metal. The area assigned to MINSAL in the Salar de Atacama has estimated reserves of 47 million tons of potassium chloride, 21.2 million tons of potassium sulfate, 4 million tons of boric acid, and 1.67 million tons of lithium metal.

A separate agreement with CORFO allows MINSAL to start producing 2,800 tons per year of lithium metal (6% of the feed), increasing by 7% per year, thereafter, up to a maximum of 13,700 tons per year of lithium. The initial capital invested was $6 million.

Nitrates and Iodine.—The Chilean Chemical and Mining Co. (SOQUIMICH), the largest producer and exporter of natural nitrate products and iodine, inaugurated a new iodine-recovery facility in response to the growing demand in the United States and Europe for natural nitrate, industrial sodium, sodium sulfate, iodine, and iodic salts. SOQUIMICH, sole producer from nitrate deposits in the Atacama Desert in northern Chile, was a Government-owned entity that was being privatized.

The new $1.8 million facility was to produce 150 tons of iodine per year with a market value of $2.5 million. The plant was in the arid Tamarugal Plains, 123 kilometers northeast of Antofagasta and would leach the tailings at SOQUIMICH's old Puelma nitrate operation. The modular plant would be transported to another site as soon as the resources at Puelma are depleted, probably in the next 5 years. The final product of this plant is a concentrate from which pure iodine is recovered at the Maria Elena and Pedro de Valdivia plants. In 1987, iodine shipped from Chile was marginally higher at 3,100 tons, but sales revenues increased considerably because of a 24% price increase to $15,928 per ton. SOQUIMICH was planning to construct a $90 million plant, close to either the Soronal or Piscis ore bodies in Region I, near the port of Iquique. It would produce 300,000 tons per year of nitrate and 1,100 tons of iodine. Ore reserves were estimated at 200 million tons of caliche (the material from which sodium nitrate, potassium nitrate,

and iodine are extracted) containing 8.6% nitrate, with a productive life to 10 years. The plant would incorporate new technology developed by SOQUIMICH from its own research. It would employ 300 workers directly and was expected to create 3,000 indirect jobs.

According to SOQUIMICH officials, the nitrate industry was experiencing an unprecedented turnaround as a result of rising international demand by agricultural, industrial, medical, and chemical industries. Chile produced and exported 35% of the iodine consumed in the world's market. Buyers for this product included China and the Soviet Union. The U.S. Department of Commerce has imposed preliminary duties of 33.4% on imports of industrial-grade sodium nitrate from Chile. SOQUIMICH was expected to appeal the ruling, which was based on charges that the company was dumping the chemical on the U.S. market.

MINERAL FUELS

Coal.—Coal production in Chile has grown steadily but was inadequate to satisfy domestic demand. The country imported 500,000 tons of metallurgical coal and 60,000 tons of coke from Australia, Canada, and the United States in 1987.

COCAR brought into production Chile's first large-scale surface coal mine at Pecket Island, Region XII, Magellan Province in southern Chile. The $75 million project includes a subbituminous steam coal mine with an output of 1.1 million tons per year. It also will have a 1.8-kilometer bulk-loading marine terminal with water depth sufficient to receive 60,000-ton vessels. The loading terminal will be one of the largest in Chile.

The Pecket coal project was expected to save Chile about $40 million in energy costs and an additional $100 million in oil imports, or about 25% of the country's oil-import costs. Pecket coal will fill the electricity needs of Region I and II in northern Chile. COCAR contracted to supply CODELCO-Chile with 880,000 tons of steam coal per year for 10 years beginning in 1987.

Coal reserves in the Pecket area were estimated at 50 million tons of proven and indicated reserves. Coal could be extracted by surface and underground mining.

COCAR was formed in 1981 by Cía. de Petróleos de Chile S.A. and Northern Strip Mining Ltd. of the United Kingdom, with 10% equity participation by the World Bank.

Cía. Carbonífera Schwager Ltda., wholly owned by Empresa Nacional del Carbón S.A. (ENACAR), itself a subsidiary of CORFO, was being privatized with 42.4% of its shares sold by yearend. The coal deposits belonging to Schwager contained probable reserves of about 12.4 million tons with a life of 35 years at current production levels. For 1988, the output was forecast at 350,000 tons.

According to estimates of the National Energy Commission, domestic demand for coal may double over the next 10 years, from 1.97 million tons to 3.78 million tons per year.

Natural Gas.—Output of natural gas declined slightly in 1987 to about 154 billion cubic feet, continuing a decline that began in 1982. From the total production 69.4% was reinjected, 4.3% was flared, and 26.3% was marketed domestically.

A plant for the production of 2,270 tons per day of chemical-grade methanol was under construction at Cabo Negro, 30 kilometers north of the city of Punta Arenas, in the Strait of Magellan. Production was to be mainly for export. Gas consumption would be 78 million cubic feet per day and would be delivered by Empresa Nacional del Petróleo (ENAP) at Cabo Negro. The plant was being built and was to be operated by Cape Horn Methanol Ltd. ENAP had a 20-year contract to supply the gas. Cape Horn Methanol's investment was about $295 million. Production was expected to start in mid-1988.

A fertilizer project was under preparation at Punta Purpesse in the Cabo Negro area, close to the ENAP and methanol plants. The proposed plant would supply 350 tons per day of ammonia and 1,725 tons per day of urea. Production was to be sold to domestic and overseas markets. ENAP was to supply 57 million cubic feet of gas per day over a 20-year period. Total investment, including financial costs, was estimated at $360 million. Combustion Engineering Inc., a U.S. firm, was to manage the project. A 185-kilometer gas pipeline of 18-inch diameter would be constructed by ENAP between its Posesion plant and Cabo Negro to supply the gas required by the methanol and fertilizer projects. The design pressure is 1,500 pounds per square inch, and in its initial stage the gas would be delivered without the need of intermediate compression stations. The pipelines also would deliver gas to the city of Punta Arenas. The additional investment, about $20 million, would be

partially financed by loans from the Inter-American Development Bank.

By yearend 1986, the purchase of pipe and coating material had been completed and the construction bid had been evaluated. Construction was scheduled to begin in early 1987, and pipeline operation would start 12 months later.

Petroleum.—Chilean crude petroleum output decreased by almost 11% to 10.9 million barrels in 1987. This output level was below the 1982 record peak of 15.6 million barrels.

Chile's sole producer of crude, ENAP, supplied only 40% of Chile's domestic demand, compared with the 59% share in 1982. Offshore production during 1987 amounted to 65% of total production. There were 32 platforms in operation in 7 oilfields. Declining production from existing oilfields in the Strait of Magellan area has forced ENAP to explore in other zones of the country including the areas of Paine, Natalies, Isla Riesco, Península de Brunswick and south of Tierra del Fuego areas in Region XII. Although earlier reports of oil discoveries in the Salar de Atacama proved untrue, they were based on the preliminary results of sesmic work under way at that time. According to ENAP officials, the results of the detailed seismic program were so promising that the signing of participation agreements was postponed until the program was completed. Private consultants familiar with the detailed seismic data considered it extremely encouraging. Accordingly, Hunt Oil Co. of the United States signed an agreement with ENAP for joint exploration of northern Chile.

ENAP was involved in a number of external arrangements to develop oil reserves outside Chile. In April, ENAP signed an agreement with Petro Canada to jointly explore for oil in Ecuador. ENAP was negotiating with Yacimientos Petrolíferous Fiscales of Argentina and Petróleo Brasileiro S.A. (PETROBRÁS) of Brazil to form a consortium to develop oil in Argentina's offshore areas.

ENAP was also negotiating the construction of offshore oil platforms for a French consortium that was exploring for oil in Argentine waters off the eastern coast of Tierra del Fuego.

ENAP planned to send a number of geologists to the Antarctic in January or February 1988 to explore for petroleum deposits on that continent. Of particular interest to ENAP were a number of islands near the Antarctic Peninsula, which have sediments the same age as those found in the Strait of Magellan.

ENAP's motive for all of the above negotiations was to diversify its activities away from its current concentration in Region XII and obtain access to additional petroleum resources.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Chilean pesos (Ch$) to U.S. dollars at the average rate of Ch$220 = US$1.00 for 1987.

The Mineral Industry of China

By E. Chin[1]

Under the seventh 5-year plan (1986-90), the Government continued to implement reform, open further to the outside world, and increase production and income. In 1987, production increased steadily, the domestic market remained brisk, economic exchanges were expanded with other countries, and achievements were made in science, technology, and social undertakings. The gross national product grew by 9.4% over that of 1986, reaching $294 billion[2] in 1987. National income was $246 billion, 9.3% higher than in 1986.[3]

Industrial reform focused on improving enterprise management. Sixty-eight percent of state-owned industrial enterprises have adopted a responsibility system invested in a director. Other reforms introduced included contract management, collective management, and leasing. Domestic horizontal economic ties between industrial enterprises were expanded further. By yearend, there were 6,780 horizontally associated industrial organizations above the county level, involving investments of $3.4 billion.

Profits of state-owned industrial enterprises were up 9.9%; per capita productivity increased 7.6%; overall product quality was maintained or improved; and industrial energy consumption was reduced by 4%. However, production costs generally increased; financial losses by less profitable enterprises rose 4.6%; and stock inventory of some products increased. All of these changes were relative to 1986.

The output value of light and heavy industry reached $318 billion, supplemented with $53 billion for the output value of village-run industry. By sector, the output value of state-owned enterprises increased 11%; collective enterprises, 25%; the private sector, 48%; and foreign-funded enterprises, 98%.

The output value of light industry was $176 billion, 16.8% more than in 1986, while that of heavy industry reached $195 billion, up 16%. The largest growth areas in production were in power generation and equipment, transportation and agricultural equipment, insecticides, and fertilizers.

The agricultural output value increased 4.7%, reaching $120 billion in 1987. Construction of farmland irrigation projects to increase agricultural production continued to be a major investment. By yearend, the aggregate power consumed by farm machinery increased 7.7%, reaching 247.2 billion watts. Power consumed by irrigation and drainage equipment was 67.9 billion watts, a 12.4% increase. Total electricity consumption in rural areas was 65.9 million kilowatt-hours, an increase of 12.3%. Application of chemical fertilizer increased 4.1%, totaling 201 million tons in 1987.

The Government continued to moderate the growth in fixed assets. The growth in this sector was reduced from 18.7% in 1986 to 16.5% in 1987, totaling $95 billion.[4] State-owned enterprises accounted for $61 billion; collectively owned enterprises, $13 billion; and individuals, $21 billion.

In state-owned enterprises, investment in capital construction increased 12.6%, totaling $36 billion in 1987. The larger investments included $8.3 billion for the energy sector, $5.5 billion for transportation and communication, $5.2 billion for raw materials, and $1 billion for light industry. The Government designated 206 projects under construction as key projects. During the year, $9.7 billion was allocated to these projects, which included oilfields, coal mines, power stations, railway lines, and

ports.

Construction of 295 projects was completed in 1987 and placed into operation. Production and other capacity added included 8.1 million kilowatts of electric power generation, 17.1 million tons of coal, 118.9 million barrels of crude oil, 272 kilometers of new railways, 433 kilometers of double-track railways, 204 kilometers of electrified railways, 9.8 million tons of port cargo handling capacity, and 3.0 million tons of cement.[5]

There was marked progress in geological surveying to delineate mineral resources. New deposits reportedly were evaluated for numerous minerals. New reserves of 31 billion tons of coal were verified. There were significant new finds of gold and other metallic deposits, industrial minerals, and oil and gas. China also conducted offshore, including deepsea, geological surveying. In 1987, a total of 8.2 million meters of mine tunneling was completed. China Geology Technology Import and Export Corp. was involved with more than 20 Sino foreign joint-venture contracts for processing diamonds, diatomaceous earths, graphite, kaolin, marble, and for manufacturing geological equipment and tools. This corporation imports computers and smelting technology while exporting mineral commodities. China Geo-Engineering Corp. has more than 20 contracts for the development of overseas mines, mostly in developing countries.

Cargo transport increased 9.2% to 2,191 billion tons-kilometer, of which 43.3% was by rail, 42.9% by water, 10.9% by highway, and 2.9% by oil and gas pipeline. The volume of cargo handled at China's major seaports was 397 million tons. Cargo carried by ships managed by the Ministry of Communication averaged 50,100 tons-kilometer, an increase of 7.4% over that of 1986. Railway and sea container transport was developing rapidly and increased 27.2% to a volume of 14.4 million tons. The use of highway transport was promoted to lessen the burden on railways. The volume of truck freight transport rose 10.5% over that of 1986.

Retail sales of all commodities continued to increase. Sales by the state-owned sector grew by 15.6%; the collective sector, 15.4%; the joint public-private sector, 26.3%; and the individual sector, 24.2%. The scope of free marketing of capital goods continued to expand, entailing a drop in materials supplied under the state distribution plan. The proportion of rolled steel under state distribution dropped from 53.1% in 1986 to 46.8% in 1987 and that of cement from 16.2% to 15.6%.

Commodity (including minerals) prices rose considerably. The urban retail price index rose 9.1% compared with 6.3% in rural areas. The average retail price index rose 7.3%. The price index for some food products rose as high as 18%, while the price index of fuel rose 3.6%.

China continued to promote exports and limit imports. In 1987, exports totaled $39.5 billion and imports $43.2 billion. Invisible trade consisting of exports and imports of services continued to expand, and invisible earnings totaled $5.38 billion, while import cost was $1.99 billion. Foreign capital increased 4.2%, reaching $7.57 billion, composed of $5.33 billion in loans and $2.24 billion in foreign investment. Contracts ratified for overseas projects and labor service totaled $1.74 billion. Overseas contracts completed in 1987 were worth $1.11 billion.

The economic strength of China's four special economic zones continued to expand. The total value of industrial output by Shantou, Shenzhou, Xiamen, and Xhuhai reached $3.0 billion, an increase of 52%, while their value of total exports reached $2.7 billion, up 114% over that of 1986. During the year, 100 foreign-funded projects went into operation. The four zones absorbed $510 million in investment, a decrease of 16% from that of 1986.

The Government continued to emphasize the development of the country's science and technology base. State prizes were awarded for 225 inventions and 807 technical items, while ministerial or local prizes were awarded for the results of 9,902 technology research projects. To promote the development of high technology, the Government approved nearly 800 research programs in 1987, involving a total investment of $54 million. The fields for these programs included biological engineering, information technology, energy, and new materials. Under the state funding for natural sciences, $35 million in subsidies were given to 2,777 projects, mostly in basic theoretical research and applied science. During 1987, nearly 4,000 projects were designated as key research projects under the seventh 5-year plan. There were 26,077 applications received by the Patent Office in 1987, and 6,811 patents were granted, more than twice as many as in 1986.

China continued to strengthen its foreign economic ties. It had active investment

protection agreements with 14 countries, and agreements were signed but not yet in force with Italy, Sri Lanka, and Switzerland. In addition to multilateral cooperation with numerous countries through organizations under the United Nations, China has signed technological cooperation agreements with countries of the Asia-Pacific region and Latin America. China is a participant in the International Monetary Fund and the World Bank. The Secretariat of the General Agreement on Tariffs and Trade (GATT) was considering restoring China's status as a contracting party. About 85% of China's total trade is with member countries of GATT. China will become a member of the United Nations Convention on Contracts for International Sale of Goods, which came into force on January 1, 1988.

By the beginning of 1987, China had opened 36 ports to foreign and Chinese ships, 18 ports to Chinese ships only, 12 ports for special services such as tourism, 19 airports for international and domestic service, and 29 frontier cities available to foreign visitors under the approval of the State Council. Aside from the 4 special economic zones, the major economic entities were 12 open coastal cities—Dalian, Qinhuangdao, Yantai, Qingdao, Lianyungang, Nantong, Ningbo, Wenzhou, Fuzhou, Guangzhou, Zhanjiang, and Beihai, from north to south.

In addition, Hainan Dao was slated as an open area. Hitherto, Hainan, an island in Nan Hai that was largely underdeveloped, was administered by Guangdong Province. In November 1987, the National People's Congress elected to elevate Hainan to the status of a Province and designated it as China's largest special-status foreign investment site. The Central Government gave Hainan special preference to spur rapid development of resources. The terms for foreign investment were to be far more preferential than those enjoyed by Shenzhen, China's largest special economic zone near Hong Kong. The first foreign company involved was CSR Ltd. of Australia in a joint venture to develop onshore oil in Hainan. Prior to Hainan's elevation to Provincial status, Atlantic Richfield Corp. of the United States discovered large natural gas deposits offshore Yinggehai. In addition to oil and gas, there are exploitable coal deposits. More than 50 mineral species have been found on the island, 33 of which have commercial development value. Those that are exploitable included minerals of chromium, cobalt, copper, gold, graphite, iron, manganese, mica, phosphate, quartz, tin, titanium, and uranium.

At the beginning of 1986, the Government began a survey of 360,000 industrial enterprises. The data collected were being processed by computer, and an analysis was completed in late 1987. The information was to be used for mapping the country's development plans for economic reform and modernization. Excerpts of the statistics were to be compiled, published, and made available to foreign parties interested in investing in China. Preliminary findings showed that there were 20 industrial cities, each with a value of gross production exceeding $2.7 billion. Collectively, they compose more than one-third of the country's value of industrial output. There were 8,285 large or medium-size industrial enterprises in China; these accounted for 43% of the value of the country's industrial output and 66% of the nation's total fixed assets. According to the survey, the largest enterprises included 11 coal mines, each with an annual production capacity of more than 10 million tons; 3 oilfields, each with an annual production capacity of more than 146 million barrels; 6 steel plants, each with an annual production capacity exceeding 2 million tons of steel; and 17 petrochemical plants. Under the seventh 5-year plan, economic development could be accelerated through domestic funding for technological transformation of existing enterprises by retooling and refurbishing and through enticing foreign investment for capital-intensive projects.

A proposal under consideration by the State Council would reduce the number of ministries and commissions from 14 to 10. Ministries such as those for rail, oil, coal, and nuclear energy would become public corporations under ministerial supervision and responsible for their own profits and losses. During the prior economic plan, the formation of public companies included China National Nonferrous Metals Industry Corp. and China National Non-Metallic Minerals Industry Corp.

PRODUCTION

China is rich in mineral resources, and its mining industry ranks high in the world in terms of mineral output. China's mine output value was estimated at $25 billion, and the value-added output of the mining industry by the processing and manufacturing sectors was $220 billion.

China's mining industry was well developed, and its output was extensive and significant by world standards. China ascended to first place in world production of cement, coal, and rare earths. It also ranks first in the production of barite and tungsten. China was a significant producer of fertilizers, fluorspar, gold, gypsum, iron ore, magnesite, manganese, salt, steel, talc, tin, and vanadium.

Table 1.—China: Estimated production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987
METALS					
Aluminum:					
Bauxite, gross weight	1,600,000	1,600,000	1,650,000	1,650,000	2,400,000
Alumina, gross weight	800,000	800,000	825,000	825,000	1,200,000
Metal, refined, primary	400,000	400,000	410,000	410,000	615,000
Antimony, mine output, Sb content	15,000	15,000	15,000	15,000	15,000
Bismuth, mine output, Bi content	260	260	260	260	260
Cadmium, smelter	300	300	300	300	300
Copper:					
Mine output, Cu content	175,000	180,000	185,000	185,000	300,000
Metal:					
Smelter, primary and secondary	195,000	210,000	225,000	225,000	300,000
Refined, primary and secondary	310,000	310,000	400,000	400,000	400,000
Gold, mine output, Au content thousand troy ounces	1,850	1,900	r1,950	2,100	2,300
Iron and steel:					
Iron ore, gross weight thousand tons	75,000	75,000	66,000	90,000	100,000
Pig iron do	37,380	39,980	43,600	50,200	53,900
Ferroalloys do	900	900	r900	r1,020	1,150
Steel, crude do	40,020	43,370	46,700	52,100	56,000
Steel, rolled do	30,720	33,710	36,900	40,500	43,900
Lead:					
Mine output, Pb content	160,000	r180,000	r200,000	r227,000	252,000
Metal, refined, primary and secondary	195,000	195,000	210,000	240,000	240,000
Magnesium metal, primary	7,000	7,000	7,000	7,000	7,000
Manganese ore, gross weight thousand tons	1,600	1,600	1,600	1,600	1,600
Mercury, mine output, Hg content 76-pound flasks	20,000	20,000	20,000	20,000	20,000
Molybdenum, mine output, Mo content	2,000	2,000	2,000	2,000	2,000
Nickel:					
Mine	13,000	r14,000	25,000	r25,000	25,000
Smelter	13,000	14,000	22,500	22,500	22,500
Silver, mine output, Ag content thousand troy ounces	2,500	2,500	2,500	3,000	3,000
Tin:					
Mine output, Sn content	15,000	15,000	15,000	15,000	15,000
Metal, smelter	15,000	15,000	15,000	15,000	15,000
Tungsten, mine output, W content	12,500	13,500	15,000	15,000	18,000
Zinc:					
Mine output, Zn content	160,000	160,000	r300,000	r396,000	425,000
Refined, primary and secondary	175,000	185,000	275,000	336,000	375,000
INDUSTRIAL MINERALS					
Asbestos	160,000	160,000	160,000	150,000	150,000
Barite thousand tons	1,000	1,000	1,000	1,000	1,000
Cement, hydraulic do	108,250	121,080	142,500	161,600	180,000
Fluorspar	650,000	650,000	650,000	650,000	650,000
Graphite	185,000	185,000	185,000	185,000	185,000
Gypsum thousand tons	4,300	4,800	5,000	6,500	7,200
Kyanite and related materials	2,500	2,500	2,500	2,500	2,500
Lithium minerals, all types	15,000	15,000	15,000	15,000	15,000
Magnesite thousand tons	2,000	2,000	2,000	2,000	2,000
Nitrogen: N content of ammonia do	13,766	14,000	15,000	15,500	15,500
Phosphate rock and apatite, P_2O_5 equivalent do	r3,400	r3,200	r1,900	r1,800	2,700
Potash, marketable, K_2O equivalent do	29	40	40	40	40
Salt do	16,130	16,000	14,450	17,300	18,000

See footnotes at end of table.

Table 1.—China: Estimated production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987
INDUSTRIAL MINERALS —Continued					
Sodium compounds: Sodium carbonate, natural and synthetic ---------- thousand tons	1,793	1,880	2,000	2,100	2,100
Sulfur:					
Native ---------- do	200	200	200	300	300
Content of pyrite ---------- do	2,300	2,300	2,300	2,500	2,500
Byproduct, all sources ---------- do	350	350	350	300	300
Total ---------- do	2,850	2,850	2,850	3,100	3,100
Talc and related materials ----------	950,000	950,000	950,000	1,000,000	1,000,000
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite ---------- thousand tons	143,000	154,000	155,000	160,000	170,000
Bituminous and lignite ---------- do	572,000	618,000	695,400	710,000	750,000
Total ---------- do	715,000	772,000	850,400	870,000	920,000
Coke, all types ---------- do	34,510	35,000	39,000	41,400	45,000
Gas, natural:					
Gross ---------- billion cubic feet	480	490	510	540	550
Marketed ---------- do	431	438	455	485	495
Petroleum:					
Crude (including crude from oil shale) thousand 42-gallon barrels	774,311	836,069	873,500	953,500	978,200
Refinery products ---------- do	500,000	550,000	655,000	700,000	710,000

[r] Revised.

[1] Table includes data available through Aug. 30, 1988.

[2] In addition to the commodities listed for which quantitative estimates of output have been made, China is known or believed to have produced other commodities for which no estimates have been prepared.

TRADE

In 1987, the value of total trade was $82.7 billion, an increase of 12% over that of 1986. China's 10 largest trading partners, in order of value, were Japan, Hong Kong and Macao, the European Economic Community, the United States, the countries of the Association of Southeast Asian Nations, the U.S.S.R., Australia, Canada, Poland, and Brazil. Total exports were valued at $39.5 billion, an increase of 27.8% over that of 1986, while imports were $43.2 billion, up 0.7%. China's trade deficit was reduced from $12 billion in 1986 to $3.7 billion in 1987. The basic Government policy was to reduce the trade deficit by decreasing imports and increasing exports.

In its effort to expand trade, the Government initiated measures to encourage exports. These reforms included delegating more decisionmaking power to trade companies and producing enterprises. Manufacturing bases were established for the manufacture of exports. The limits on export control were relaxed to encourage freer exports. The export of finished products was encouraged, while imports of manufactures were restricted. There would be freer imports of raw materials, technology, and equipment deemed vital to the development of industry and agriculture.

On the international scene, the prices of finished products were generally higher. The reevaluation of the Japanese yen and other currencies strengthened the competitiveness of Chinese goods.

The major mineral-related trading companies were China National Chemicals Import and Export Corp. and China National Metals & Minerals Import and Export Corp. The major trade commodities, those valued at more than $100 million, were exports of coal, crude oil, and petroleum refinery products and imports of aluminum, copper, fertilizers, iron ore, soda ash, and steel.[6]

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals	107	605	80	Japan 475.
Aluminum:				
Ore and concentrate	491,517	562,271	181,080	West Germany 116,524; Italy 47,120; Japan 44,444.
Oxides and hydroxides	10,685	4,143	535	Pakistan 2,204; Thailand 779.
Metal including alloys:				
Scrap	166	249	--	Hong Kong 229; West Germany 20.
Unwrought	715	523	--	Hong Kong 239; Thailand 186.
Semimanufactures	4,967	5,089	7	Hong Kong 4,721.
Antimony:				
Ore and concentrate	1,867	979	--	All to Japan.
Oxides	915	1,950	--	Do.
Metal including alloys, all forms	1,203	6,198	--	Japan 3,982; Yugoslavia 2,115.
Arsenic: Oxides and acids	76	116	--	All to Hong Kong.
Beryllium:				
Oxides and hydroxides	--	10	--	All to Japan.
Metal including alloys, all forms	--	10	--	Do.
Bismuth: Metal including alloys, all forms	17	--		
Cadmium: Metal including alloys, all forms	--	20	--	All to Netherlands.
Chromium:				
Ore and concentrate	665	1,749	406	France 575; Hong Kong 391.
Metal including alloys, all forms	83	60	--	All to Netherlands.
Cobalt: Oxides and hydroxides	10	40	--	Singapore 25; Hong Kong 12.
Columbium and tantalum: Metal including alloys, all forms, tantalum kilograms	--	84	84	
Copper:				
Sulfate	--	360	--	Japan 278; Hong Kong 82.
Metal including alloys:				
Scrap	1,002	2,053	--	Hong Kong 1,998.
Unwrought	481	266	57	West Germany 87; Japan 67.
Semimanufactures	5,101	9,714	11	Hong Kong 9,444.
Gold: Metal including alloys, unwrought and partly wrought troy ounces	835	324,158	--	All to Hong Kong.
Indium: Metal including alloys, all forms	--	8	--	All to Japan.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	350	2,026	--	Greece 1,772; France 155.
Metal:				
Scrap	21,362	2,896	--	Hong Kong 2,628; Japan 266.
Pig iron, cast iron, related materials	1,927	5,725	5,481	Hong Kong 218.
Ferroalloys:				
Ferrochromium	--	134	--	All to Netherlands.
Ferromanganese	662	1,527	--	Pakistan 825; Japan 700.
Ferromolybdenum	--	81	--	All to Sweden.
Unspecified	4,996	54,571	1,173	Japan 41,804; Hong Kong 4,766.
Steel, primary forms	5,429	997	--	Thailand 977.
Semimanufactures	176,598	271,338	22,475	Hong Kong 205,400; Singapore 20,185.
Lead:				
Ore and concentrate	--	10,917	--	Japan 10,166; Thailand 701.
Oxides	876	2,069	--	Japan 885; Pakistan 514; West Germany 385.
Metal including alloys:				
Scrap	108	167	3	Hong Kong 164.
Unwrought	1,069	925	78	North Korea 693; Japan 149.
Semimanufactures	6	45	--	All to Hong Kong.
Lithium: Oxides and hydroxides	252	81	--	All to Japan.
Manganese:				
Ore and concentrate	4,427	4,320	--	Japan 3,621; Hong Kong 341.
Oxides	1,157	2,026	--	Hong Kong 1,196; Pakistan 519; Thailand 247.
Metal including alloys, all forms	383	322	--	Netherlands 201; Sweden 121.
Mercury 76-pound flasks	7,695	12,034	4,728	Hong Kong 3,425; Pakistan 841.
Molybdenum:				
Ore and concentrate	--	4,693	--	Netherlands 4,561.
Metal including alloys, all forms	51	72	25	Japan 28; West Germany 18.
Nickel:				
Ore and concentrate	--	6	--	All to Finland.
Oxides and hydroxides	--	18	--	All to Hong Kong.
Metal including alloys, all forms	68	2,242	532	Japan 1,599.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$1,296	$5,689	$1,118	West Germany $3,184; Japan $650.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Rare-earth metals including alloys, all forms	112	83	--	All to Japan.
Silver:				
Ore and concentrate value, thousands	--	$636	$636	
Waste and sweepings[2] do.	--	$756	--	United Kingdom $677; Japan $79.
Metal including alloys, unwrought and partly wrought do.	$12,238	$8,022	$8	France $7,996.
Tin:				
Ore and concentrate	7,702	6,399	--	Singapore 3,556; Hong Kong 1,755.
Oxides	208	1,185	--	Japan 784; Singapore 373.
Metal including alloys:				
Scrap	20	27	--	Chile 22.
Unwrought	14,164	7,633	3,023	Hong Kong 2,613; Japan 1,651.
Semimanufactures	749	327	--	Hong Kong 323.
Titanium:				
Oxides	3,397	3,902	701	Hong Kong 2,009.
Metal including alloys, all forms	100	--		
Tungsten:				
Ore and concentrate	7,136	5,595	950	Hong Kong 3,457; West Germany 675.
Oxides and hydroxides	15	--		
Metal including alloys, all forms	[3]83	141	16	Singapore 90; West Germany 33.
Uranium and thorium:				
Ore and concentrate	32	--		
Metal including alloys, all forms value, thousands	$24	$24	--	Chile $15; Pakistan $9.
Vanadium: Oxides and hydroxides	2,290	299	--	All to Japan.
Zinc:				
Oxides	2,055	3,062	--	Japan 993; Hong Kong 786; Singapore 302.
Blue powder	--	2	--	All to Hong Kong.
Metal including alloys, all forms	2,787	48,022	1,342	Hong Kong 35,062; Japan 8,382.
Zirconium: Ore and concentrate	1,107	--		
Other:				
Ores and concentrates	21,965	30,972	1,895	Hong Kong 8,196; France 6,660; Greece 6,101.
Oxides and hydroxides	8,302	343	--	Hong Kong 190; Canada 153.
Ashes and residues	4,646	6,400	238	Hong Kong 5,878.
Base metals including alloys, all forms:				
Quantity, reported	5,050	14,371	5,238	Hong Kong 5,656; West Germany 1,083.
Value only, reported thousands	$30,784	$425	--	Canada $339; New Zealand $86.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	3,086	7,147	--	Hong Kong 6,240.
Artificial:				
Corundum	22,205	36,778	627	Hong Kong 18,019; Japan 17,806.
Silicon carbide	12,878	17,786	1,401	Japan 14,672; Hong Kong 1,713.
Dust and powder of precious and semi-precious stones value, thousands	$20	--		
Grinding and polishing wheels and stones	5,069	4,711	[4]129	Hong Kong 2,558; Singapore 1,208.
Asbestos, crude	348	444	--	Thailand 343; Hong Kong 82.
Barite and witherite	971,171	492,270	389,643	West Germany 32,089; Japan 30,927.
Boron materials:				
Crude natural borates value, thousands	NA	$3	$2	New Zealand $1.
Oxides and acids	1,513	2,112	1	West Germany 552; Japan 441; Pakistan 345.
Cement	97,220	156,519	49	Hong Kong 156,319.
Chalk	17	75	1	Pakistan 56; West Germany 14.
Clays, crude	252,339	252,442	--	Japan 117,385; Hong Kong 116,961.
Cryolite and chiolite	200	50	45	Singapore 5.
Diamond:				
Gem, not set or strung value, thousands	$30,470	$10,669	$1,724	Hong Kong $4,547; Belgium-Luxembourg $3,201.
Industrial stones do.	$968	$3,771	--	Belgium-Luxembourg $2,751; Hong Kong $1,020.
Diatomite and other infusorial earth	11	219	100	Thailand 100.
Feldspar, fluorspar, related materials	433,703	80,741	--	Hong Kong 37,396; West Germany 27,077.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Fertilizer materials:				
Crude, n.e.s	120	106	--	All to Hong Kong.
Manufactured:				
Ammonia	9,528	2,058	--	Hong Kong 1,863.
Nitrogenous	2,113	3,813	339	Hong Kong 2,173; Japan 617.
Phosphatic	20,624	29,766	--	Japan 29,213.
Potassic	1,411	--	--	
Unspecified and mixed	[5]47	3,272	1	Singapore 1,611; Japan 1,395.
Graphite, natural	62,801	81,109	10,030	Japan 30,944; West Germany 17,848.
Gypsum and plaster	3,082	3,503	--	Hong Kong 2,788; Singapore 511.
Kyanite and related materials	--	20	--	All to Japan.
Lime	43,555	44,125	--	Hong Kong 43,825.
Magnesium compounds, unspecified	247,362	519,046	39,515	Japan 232,626; West Germany 87,403.
Mica:				
Crude including splittings and waste	16,743	2,752	1	West Germany 2,494.
Worked including agglomerated splittings	55	60	--	France 21; United Kingdom 20; Spain 10.
Phosphates, crude	1,349	1,590	--	Japan 1,572.
Phosphorus, elemental	18	--		
Pigments, mineral:				
Natural, crude	595	932	--	All to Hong Kong.
Iron oxides and hydroxides, processed	5,732	5,131	13	Hong Kong 2,406; Pakistan 1,993.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$2,528	$4,815	$334	Hong Kong $4,142; Japan $174.
Synthetic do	$78	$335	$29	Hong Kong $232; Italy $32.
Pyrite, unroasted	--	7,531	--	All to Japan.
Salt and brine	785,447	162,930	--	Hong Kong 119,012; Philippines 37,411.
Sodium compounds, n.e.s.:				
Carbonate, natural and manufactured	2,542	5,114	--	Hong Kong 4,858; United Kingdom 146.
Sulfate, natural and manufactured	8,145	102,008	--	Japan 56,711; Hong Kong 44,388.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	92,484	153,482	32	Japan 136,991; Hong Kong 13,002.
Worked	22,060	38,201	4,488	Japan 23,760; Singapore 5,641.
Gravel and crushed rock	3,065,967	4,593,455	([6])	Hong Kong 4,590,111.
Limestone other than dimension	40,523	38,125	--	Hong Kong 38,124.
Quartz and quartzite	2,962	8,230	38	Hong Kong 8,088.
Sand other than metal-bearing	1,103,276	1,270,859	--	Hong Kong 1,270,824.
Sulfur:				
Elemental:				
Crude including native and by-product	11,764	33,603	--	Thailand 24,291; Hong Kong 5,242.
Colloidal, precipitated, sublimed	6,022	761	--	Philippines 500; Pakistan 194.
Sulfuric acid	5,140	6,473	--	All to Hong Kong.
Talc, steatite, soapstone, pyrophyllite	490,669	541,125	2,994	Japan 456,318; Hong Kong 32,172.
Other:				
Crude	24,150	34,414	339	Pakistan 16,044; Hong Kong 6,114.
Slag and dross, not metal-bearing	8,258	8,935	--	Japan 7,206; United Kingdom 687.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	20	--		
Carbon black	2,613	3,024	--	Thailand 1,130; Hong Kong 644; Pakistan 559.
Coal:				
Anthracite and bituminous thousand tons	4,729	5,474	([7])	Japan 3,770; Hong Kong 1,078.
Lignite including briquets	759	1,040	--	All to Japan.
Coke and semicoke	18,778	25,103	--	Thailand 18,825; Japan 3,607.
Peat including briquets and litter	--	100	--	All to Japan.
Petroleum:				
Crude thousand 42-gallon barrels	116,626	183,919	30,355	Japan 95,119; Singapore 47,014.
Refinery products:				
Liquefied petroleum gas do	163	109	--	Hong Kong 82; Thailand 15.
Gasoline do	22,614	18,976	7,323	Japan 10,887.
Naphtha including white spirit do	--	1,938	--	All to Hong Kong.
Mineral jelly and wax do	561	648	48	Hong Kong 243; Singapore 157.
Kerosene and jet fuel do	3,036	2,923	--	Japan 1,529; Hong Kong 1,394.
Distillate fuel oil do	15,411	12,340	--	Singapore 4,902; Hong Kong 4,812; Japan 1,390.
Lubricants do	871	1,032	425	Thailand 322; Hong Kong 191.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products —Continued				
Residual fuel oil thousand 42-gallon barrels	3,360	3,783	2	Japan 2,423; Hong Kong 1,298.
Bitumen and other residues do.	27	15	--	All to Hong Kong.
Petroleum coke do.	799	773	--	Mainly to Japan.
Unspecified do.	--	56	--	All to Poland.

[p]Preliminary. NA Not available.
[1]Table prepared by Audrey D. Wilkes. Owing to a 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 United Nations information and data published by the trading partner countries.
[2]May include platinum-group metals.
[3]Excludes unreported quantities imported by Japan and Hong Kong valued at $120,000 and $105,000, respectively.
[4]Excludes unreported quantity valued at $150,000.
[5]Excludes unreported quantity imported by Japan valued at $347,000.
[6]Unreported quantity valued at $2,000.
[7]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals	--	1	--	All from Japan.
Aluminum:				
Ore and concentrate	127	--		
Oxides and hydroxides	80,972	107,787	7	Singapore 106,832; Hong Kong 632.
Metal including alloys:				
Scrap	459	1,141	504	Hong Kong 622.
Unwrought	234,421	91,519	3	Australia 65,484; New Zealand 16,134.
Semimanufactures	74,099	43,211	72	Hong Kong 16,728; Japan 11,595; West Germany 5,062.
Arsenic: Oxides and acids	--	216	--	All from Hong Kong.
Beryllium: Metal including alloys, all forms value, thousands	$2	--		
Bismuth: Metal including alloys, all forms	--	34	--	All from Japan.
Chromium:				
Ore and concentrate	16,913	47,073	--	Pakistan 25,598; Philippines 21,471.
Oxides and hydroxides	56	287	51	Japan 203.
Metal including alloys, all forms	2	--		
Cobalt: Oxides and hydroxides kilograms	--	25	--	All from Japan.
Columbium and tantalum: Metal including alloys, all forms, tantalum	(2)	4	--	Do.
Copper:				
Ore and concentrate	76,032	64,679	12,493	Canada 30,373; Philippines 17,621.
Oxides and hydroxides	54	144	--	All from Hong Kong.
Sulfate	8	2,016	--	Yugoslavia 2,000.
Metal including alloys:				
Scrap	18,916	31,681	443	Japan 16,473; Chile 10,092.
Unwrought	113,839	50,539	--	Chile 19,024; Philippines 18,513; Poland 9,001.
Semimanufactures	27,892	34,547	30	Japan 19,184; Poland 8,470; Hong Kong 5,843.
Gold:				
Ore and concentrate value, thousands	$5,107	$1,583	--	All from Philippines.
Metal including alloys, unwrought and partly wrought troy ounces	11,000	616	--	All from Japan.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	9,176,413	8,708,696	--	Australia 8,708,672.
Metal:				
Scrap	496,545	649,371	308,130	Japan 244,582; United Kingdom 61,966.
Pig iron, cast iron, related materials	2,592,775	790,185	--	Japan 713,354; Canada 52,105.
Ferroalloys:				
Ferromanganese	6,664	720	--	All from Japan.
Unspecified	974	31	24	Hong Kong 6.
Steel, primary forms	1,742,182	858,814	--	Argentina 275,183; Australia 178,990; Italy 114,306.
Semimanufactures thousand tons	14,356	11,833	17	Japan 7,752; West Germany 730; Spain 663.
Lead:				
Oxides	28	6	--	Japan 4; Hong Kong 2.
Metal including alloys:				
Scrap	1,229	1,101	--	All from Hong Kong.
Unwrought	3,423	3,116	83	Japan 1,600; Canada 1,000.
Semimanufactures	139	73	(3)	Hong Kong 42; Japan 31.
Magnesium: Metal including alloys, all forms	3,078	4,079	2,930	Japan 783; Hong Kong 366.
Manganese: Oxides	24	56	--	All from Hong Kong.
Mercury 76-pound flasks	118	--		
Molybdenum: Metal including alloys, all forms	2	1	--	All from West Germany.
Nickel: Metal including alloys, all forms	211	238	16	Hong Kong 82; Japan 73.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$4,574	$4,715	$1,006	United Kingdom $3,531.
Selenium, elemental	--	15	--	All from Japan.
Silver:				
Ore and concentrate value, thousands	$735	$6,018	$380	Canada $4,492.
Waste and sweepings do.	--	$8	--	Canada $6; Singapore $2.
Metal including alloys, unwrought and partly wrought thousand troy ounces	1,113	[4]17,705	--	United Kingdom 17,426.
Tin:				
Ore and concentrate	257	199	--	All from Hong Kong.
Metal including alloys, all forms	147	855	542	Hong Kong 296.
Titanium:				
Oxides	10,852	8,448	2,078	Japan 4,830; Hong Kong 829.
Metal including alloys, all forms	--	196	--	All from Japan.
Tungsten: Metal including alloys, all forms	[5]6	6	(6)	Japan 4.
Uranium and thorium:				
Ore and concentrate	4	1	--	All from Japan.
Oxides and other compounds	--	2	--	All from Hong Kong.
Zinc:				
Ore and concentrate	21,826	2,281	--	All from Canada.
Oxides	3,311	504	--	Singapore 294; France 100.
Blue powder	--	51	--	All from Hong Kong.
Metal including alloys, all forms	181,514	47,298	--	Thailand 11,602; Hong Kong 8,301; Australia 7,171.
Zirconium: Ore and concentrate	100	--		
Other:				
Ores and concentrates	16,935	12,579	--	Australia 10,777; Hong Kong 1,802.
Oxides and hydroxides	31,167	--		
Ashes and residues	394	485	(7)	Canada 260; Hong Kong 166.
Base metals including alloys, all forms	532	885	13	Hong Kong 809.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	611	668	--	Hong Kong 667.
Artificial:				
Corumdum	15	202	14	Hong Kong 136; Japan 40.
Silicon carbide	231	30	--	Hong Kong 23.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$9	$20	$3	Japan $11; Hong Kong $6.
Grinding and polishing wheels and stones	325	[8]717	9	Hong Kong 311; Italy 166; Japan 121.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Asbestos, crude	839	254	--	Canada 243.
Barite and witherite	NA	25	25	
Boron materials: Oxides and acids	40	3	--	All from Hong Kong.
Cement	644,347	1,234,365	4	U.S.S.R. 662,000; Hong Kong 534,113.
Clays, crude	3,026	3,755	1,225	Hong Kong 1,992; Japan 446.
Diamond:				
Gem, not set or strung value, thousands	$8,581	$10,815	$713	Belgium-Luxembourg $8,166; Hong Kong $1,573.
Industrial stones do.	$8,453	$10,257	$2,159	Belgium-Luxembourg $4,145; Hong Kong $2,342.
Diatomite and other infusorial earth	1,277	953	382	Hong Kong 417; Japan 143.
Feldspar, fluorspar, related materials	28	289	--	Hong Kong 283.
Fertilizer materials:				
Crude, n.e.s	224	301	--	Hong Kong 298.
Manufactured:				
Ammonia	1	47	--	All from Hong Kong.
Nitrogenous -- thousand tons	1,617	1,121	--	U.S.S.R. 996; Pakistan 42.
Phosphatic do.	84	587	--	Tunisia 256; Philippines 244.
Potassic do.	276	347	--	Canada 311; Greece 34.
Unspecified and mixed do.	989	268	--	Italy 55; Belgium-Luxembourg 46; Greece 31.
Graphite, natural	26	10	--	Mainly from Hong Kong.
Gypsum and plaster	1,362	544	16	Hong Kong 430.
Iodine including bromine and fluorine	10	170	--	Mainly from Japan.
Kyanite and related materials	--	4	--	All from Japan.
Lime	189	132	--	Japan 65; Hong Kong 47.
Magnesium compounds, unspecified	220	285	--	Japan 253.
Mica:				
Crude including splittings and waste	8	--		
Worked including agglomerated splittings	27	70	1	Hong Kong 69.
Nitrates, crude	49,998	88,466	--	All from Chile.
Phosphates, crude	111,000	244,850	--	All from Morocco.
Pigments, mineral:				
Natural, crude	--	18	--	All from Hong Kong.
Iron oxides and hydroxides, processed	1,131	923	83	Hong Kong 663; Japan 175.
Potassium salts, crude	--	188,302	--	All from Jordan.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$8,164	$12,082	$41	Hong Kong $11,198; West Germany $805.
Synthetic do.	$275	$219	--	Hong Kong $120; Australia $49.
Salt and brine	696	702	--	Hong Kong 666.
Sodium compounds, n.e.s.:				
Carbonate, natural and manufactured	187,579	767,315	212,189	Hong Kong 377,713; Poland 111,909.
Sulfate, natural and manufactured	315	141	--	All from Hong Kong.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	1,027	50,363	--	Jordan 49,600; Hong Kong 512.
Worked	10,733	10,292	182	Hong Kong 9,507; Italy 521.
Dolomite, chiefly refractory-grade	36	43	--	Hong Kong 36; Japan 7.
Gravel and crushed rock	964	967	15	Hong Kong 916.
Limestone other than dimension	2,034	1,261	--	All from Hong Kong.
Quartz and quartzite	--	79	--	Spain 70.
Sand other than metal-bearing	1,516	275	--	Hong Kong 233; Netherlands 26.
Sulfur:				
Elemental:				
Crude including native and by-product	162,610	332	332	
Colloidal, precipitated, sublimed	17	9	--	All from Hong Kong.
Sulfuric acid	16,129	104	13	Hong Kong 56; Japan 30.
Talc, steatite, soapstone, pyrophyllite	514	678	200	Hong Kong 461.
Other:				
Crude	254	364	5	Hong Kong 289; Singapore 30.
Slag and dross, not metal-bearing	6	67	--	Hong Kong 62.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	18	21	--	All from Hong Kong.
Carbon black	11,253	2,834	228	Hong Kong 2,073; Australia 321.
Coal:				
Anthracite and bituminous	524,272	472,350	--	Australia 472,343.
Lignite including briquets	7	139	139	
Peat including briquets and litter	--	285	--	Japan 272; Netherlands 13.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	[9]58	45,228	116	Hong Kong 43,697; United Kingdom 1,392.
Gasoline do	52,955	44,732	1,504	Hong Kong 35,808; Belgium-Luxembourg 5,738.
Mineral jelly and wax do	2,723	5,579	47	Hong Kong 4,643; Netherlands 433.
Kerosene and jet fuel do	15,415	22,069	--	Hong Kong 18,310; Yugoslavia 3,658.
Distillate fuel oil do	260,530	10,540,585	300,108	Singapore 7,824,764; Hong Kong 2,393,989.
Lubricants do	147,669	217,968	10,521	Hong Kong 142,136; Japan 38,642.
Residual fuel oil do	114,080	4,044,305	122,591	Singapore 2,116,548; Hong Kong 1,763,002.
Bitumen and other residues do	19,543	7,926	--	Singapore 6,060; Hong Kong 1,151.
Bituminous mixtures do	303	352	--	Japan 182; Hong Kong 146.
Petroleum coke do	37,836	--		

[p]Preliminary. NA Not available.

[1]Table prepared by Audrey D. Wilkes. Owing to a 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 United Nations information and data published by the trading partner countries.

[2]Unreported quantity exported by Japan valued at $3,000.

[3]Unreported quantity valued at $5,000.

[4]Excludes unreported quantities exported by Australia and Belgium-Luxembourg valued at $3,409,000 and $4,000, respectively.

[5]Excludes unreported quantity exported by Hong Kong valued at $720,000.

[6]337 kilograms of wire valued at $50,000.

[7]Unreported quantity valued at $22,000.

[8]Excludes unreported quantities exported by Canada and the United Kingdom valued at $85,000 and $1,000, respectively.

[9]Excludes unreported quantity exported by Japan valued at $14,000.

COMMODITY REVIEW

METALS

China produces a wide array of metals. Although the output was significant in context of world production, it was inadequate to satisfy domestic demand in light of the country's large population. The output of such commodities as rare earths and tungsten was largely export-oriented, meeting domestic consumption as well as any large foreign demand. China was a net importer of metals such as aluminum, copper, and steel for its domestic requirements.

China's metals generally fell into 10 categories; the largest, by tonnage, was iron and steel. The light metal category included aluminum. The heavy metal category included antimony, bismuth, cadmium, chromium, cobalt, copper, manganese, mercury, nickel, tin, and zinc. The light rare metals were beryllium, lithium, and titanium; the refractory rare metals were columbium and tantalum, molybdenum, tungsten, vanadium, and zirconium; and the rare dispersed metals were gallium, germanium, indium, and thallium. The rare-earth metals (lanthanide series) and the platinum-group metals were each categorized into its own grouping. Gold and silver were the precious metals, while the semimetals were arsenic and silicon.

For general reporting, the Chinese literature refers to aluminum, antimony, copper, lead, magnesium, mercury, nickel, tin, titanium, and zinc as the 10 major nonferrous metals. Overall production of these metals in 1987 was about 1.5 million tons.

Overall, the output of nonferrous metals by the end of the seventh plan was to be 45% more than that at the end of the sixth plan. Individually, China National Nonferrous Metals Industry projected growth rates during 1986-90 of 90% for aluminum, 12% for copper, 31% each for lead and zinc, and 100% for nickel.[7]

Aluminum.—Consumption of aluminum exceeded 800,000 tons, of which 40% was imported. Under the current economic plan, the Government gave priority to developing the aluminum sector. New metal produc-

tion came from recently completed plants in Gansu, Guizhou, and Qinghai. When full production capacity is on-stream, total production in 1988 should exceed 600,000 tons. Further increases in metal production would come from plants under construction in Guangxi, Qinghai, and Shaanxi. By 1990, the national output capacity was expected to reach close to 1.1 million tons per year.

There were large bauxite deposits in Shanxi and in southern China, principally in Guangxi, Guizhou, and Hunan. Annual mine output of bauxite was expected to exceed 4.4 million tons by 1990 to meet the demand for metal production and for abrasive, chemical, and refractory uses. Large alumina refineries were near the minesites at Pingguo, Guanxi; Guiyang, Guizhou; and Zhengzhou, Hunan. Collectively, these refineries were to supply about 85% of China's alumina requirements.

Copper.—China's consumption of copper was 800,000 tons. Domestic metal production constituted 60% of the supply; imports, 35%; and secondary recovery, the remainder. The country's largest copper-producing operation was in Jiangxi Province centered around the Dexing mining complex and the nearby smelting-refining complex at Guixi. The annual output at Dexing-Guixi was 200,000 tons of copper in concentrate and 90,000 tons of refined metal.

Construction continued in the nonferrous metal production center at Baiyin, Gansu, in northwestern China, which includes copper smelting-refining facilities. Nearby copper deposits were to be mined to provide feed for Baiyan to produce 110,000 tons of copper per year. The only other major project for primary metal production was a proposed 100,000-ton-per-year refinery in Tianjin. A minor but expanding supply of copper was secondary metal from China's increased activities in shipbreaking.

Notwithstanding the projected production capacity of 665,000 tons per year of refined metal, China was expected to continue to import annually 250,000 tons of copper.

Gold.—The planned annual growth in gold production was 15% during 1986-90. However, the increase in gold output was 11% in 1986 and only 10% in 1987, reaching a total output of 2.3 million troy ounces. Heilongjiang, Henan, and Shandong are the main gold-producing Provinces. Output each in Hebei, Jilin, Liaoning, and Nei Monggol varies between 50,000 and 100,000 ounces annually. Although gold has been reportedly found in 1,000 counties in China, mining was being carried out in only 400 counties. Cooperatives and individuals were encouraged to mine gold, which was formerly restricted to state-owned enterprises. However, all gold output must be sold to the Government.

Prospecting has revealed 4,000 more gold finds in various localities throughout the country. Although China's gold reserves are large, they rank sixth in the world after the Republic of South Africa, the U.S.S.R., the United States, Canada, and Australia. China's gold-mining sector has an estimated work force of 100,000 encompassing prospecting to mining and research.

Iron and Steel.—China's steel industry centers around 56 plants, of which 14 produce more than 1 million tons per year. Numerous small iron and steel mills throughout the country produce one-fifth of the national output. The largest steel complex, at Anshan, Liaoning, has an annual production capacity of 7.5 million tons. Anshan was being renovated, and annual capacity was to be expanded to 10 million tons. The second-largest steel complex, at Wuhan, Hubei, was undergoing expansion to increase annual capacity from 4.5 to 7 million tons. The newly completed steel complex at Baoshan, outside Shanghai, ranks third, and upon completion of its second-stage construction, annual production capacity will increase from 3.7 million to 6.7 million tons.

During 1981-85, the annual increase in steel production averaged more than 2 million tons, and output rose from 35.6 to 46.7 million tons. During the seventh 5-year plan, the average annual increase was to be 3 million tons, to reach an annual output capacity of 64.1 million tons in 1990. Notwithstanding the planned increase in output by 1990, China will remain fourth in world production after the U.S.S.R., Japan, and the United States.

China's output in 1987 of crude steel was 56.0 million tons; rolled steel, 43.9 million tons; pig iron, 53.9 million tons; and iron ore, 151.5 million tons, representing an average increase of 8% each.

In addition to plant expansions previously mentioned, expansions were slated for the steel complexes at Ma'anshan, Anhui; Xuanhua, Hebei; Maashan, Jiangsu; Benxi, Liaoning; Laiwu, Shandong; and Panzhihua, Sichuan. New steel complexes were proposed for Meishan, Jiangsu; Shenzhen, Guangdong; and Ningbo, Zhejiang. Mini-

mills were proposed for Meizhouwan, Fujian; Guangzhou, Guangdong; and Beihai, Guangxi.

An iron and steel seminar that was to be held in Beijing in late 1987, cosponsored by the U.S. Department of Commerce and China's Ministry of Metallurgical Industry, was canceled. The seminar was to explore avenues to finance the modernization and expansion of China's steel industry. Subsequently, the State Council gave approval for the establishment of China International Iron and Steel Investment Corp., whose charter was to attract foreign funds and to import technology and equipment for accelerating the growth of the domestic steel industry.

China has 120 shipbreaking yards employing 40,000 workers. Most of the shipbreaking activities, which provide scrap metal for the steel sector, were in Dalian, Fuzhou, Guangzhou, Lianyungang, Qingdao, Qinhuangdao, Shanghai, Tianjin, Xiamen, and Yantai. Although the industry is new to China, the country was the world's third largest in shipbreaking. Moreover, the state has allocated funding to upgrade technology as well as to expand shipbreaking capacity. By 1990, China's shipbreaking capacity was expected to rank second in the world.

Lead and Zinc.—China's annual demand for lead and zinc was 185,000 tons and 500,000 tons, respectively. The large refineries were in Huludao and Shenyang in Liaoning and Zhuzhou, Hunan. Output capacity at these plants, as well as at the refinery at Shaoguan, Guangdong, was being expanded. The lead-zinc mine at Fankuo, Guangdong, was being expanded to provide feed for metal production at Shaoguan. New annual production of 50,000 tons of lead and 100,000 tons of zinc was to begin in 1988 at the nonferrous metal production center in Baiyun, Gansu. By 1989, China's annual capacity to produce lead was expected to reach 250,000 tons and for zinc, 400,000 tons. Currently, China imports 10,000 tons of lead and 200,000 tons of zinc annually.

Rare Earths.—China's verified reserves of rare earths at Bayan Obo alone were the largest in the world. Rare-earth production in 1987 reached 18,000 tons, probably replacing the United States as the world's largest producer. In addition to approximately 30 producing refineries, there are 300 universities and research institutes engaged in rare-earth extraction and application. Consumption of rare earths in China exceeds 5,000 tons per year. The uses were extensive and included mischmetal in iron and steel, petrochemicals, optical glass, tanning, dyeing, agriculture, and laser and microwave technology. China was a large exporter of rare earths and yttrium to Japan and Europe.

Tin.—China's reserves of tin were estimated to constitute as much as one-quarter of the world's total reserves. Its tin reserves were concentrated in the south, stretching from Hunan, through Guangdong and Guangxi, to Yunnan. The country's largest tin producer was Yunnan Tin Corp., followed by Dachang Tin Mining Bureau in Guangxi. The combined annual tin output of these two accounted for more than 60% of China's production of tin-in-concentrate. Although China is a tin-rich nation, it plays a minor role in world commerce, with exports averaging only 7,000 tons of ingot and 5,000 tons of ore during 1985-86.

Tungsten.—China had large resources of tungsten in wolframite and scheelite, and its reserves were equivalent to three times those of the rest of the world. The large tungsten occurrences were in southern China, mainly in Jiangxi, Hunan, and Guangdong Provinces. The mining and processing of tungsten ore was by China National Nonferrous Metals Industry, whose marketing subsidiary was responsible for exporting tungsten products. China ranks first in world production of concentrate, and its exports of tungsten products have accounted for up to 50% of tungsten world trade. Jiangxi was the largest producing Province, followed by Hunan. Ten large tungsten mines were in operation in southern Jiangxi, which was considered the tungsten capital of China.

China's exports continued to be mainly concentrates, not value-added products. In 1985, the China Tungsten Industry Association was formed in Nanchang, Jiangxi, with membership from the various mining, processing, and metallurgical operations. This association was to coordinate and assist the various tungsten mining operations and ore processors in producing higher quality goods and materials.

Inferior technology and products notwithstanding, China continued to dominate the world's export market for tungsten in 1987. By the mid-1980's, tungsten producers in Europe and the United States were petitioning for restraint in China's export volume and price. With no restraint notice-

able, U.S. producers of ammonium paratungstate (APT) and tungstic acid petitioned for official relief through the U.S. International Trade Commission (ITC). On June 5, 1987, the five commissioners of the ITC unanimously voted that there was market disruption with respect to imports from China of APT and tungstic acid for the following reasons:

1. The domestic industry has suffered losses in employment, profits, and production.

2. The economic costs of relief in terms of consumer cost, inflationary impact, and national economic welfare would be small because of the small size and structure of the domestic industry.

3. Relief will help maintain a viable domestic processing industry, because tungsten was a strategic metal and the legislated national stockpile was based on continued domestic processing capabilities.

4. Imports from China were at very low levels around 1980 but nearly tripled between 1982 and 1986, when they accounted for 85% of imports and 17.8% of U.S. consumption. Imports from China as a percentage of consumption had risen to 28.6% in the first 4 months of 1987.

5. Other countries were considering protecting their producers, which would increase pressure on the U.S. market to absorb additional imports.

6. An orderly marketing agreement was likely to deal more effectively with possible circumvention of the import restrictions.

On September 28, 1987, the Governments of the United States and China entered into an orderly marketing agreement with respect to trade in APT and tungstic acid, effective October 1, 1987. Chinese exports to the United States were restricted as follows:

	Specified limit (million pounds of tungsten content)
If entered during the period from Oct. 1, 1987, through Dec. 31, 1987, inclusive	0.425
If entered during the period from Jan. 1, 1988, through Dec. 31, 1988, inclusive	1.81
If entered during the period from Jan. 1, 1989, through Dec. 31, 1989, inclusive	1.94
If entered during the period from Jan. 1, 1990, through Dec. 31, 1990, inclusive	2.05
If entered during the period from Jan. 1, 1991, through Sept. 30, 1991, inclusive	1.50

To offset U.S. quota limitations, China was expected to increase its exports of tungsten in the form of ore and concentrate; miscellaneous compounds; metal, alloys, and carbide; and waste and scrap to offset the loss in shipments of APT and tungstic acid.

INDUSTRIAL MINERALS

China's production of industrial minerals was large and extensive. The industry was largely composed of the Ministry of Chemical Industry (MCI) and the State Administration of Building Materials (SABM). MCI employs more than 2.8 million people in more than 550 chemical works, while SABM has more than 4 million people in 50,000 enterprises. MCI was responsible for pyrite, phosphate and chemical fertilizer, sulfur, caustic soda, soda ash, and a wide spectrum of other chemical products. SABM's jurisdiction included cement and ceramics, glass, and other products including asbestos, clays, graphite, gypsum, magnesite, and mica.

Other companies included China Petro-Chemical Corp., also known as SINOPEC, and China National Non-Metallic Minerals Industry Corp. Although China's output of industrial minerals was largely domestically consumed, the large excesses in production of barite, clays, feldspar, fluorspar, graphite, magnesite, and talc were exported.

Barite.—China was one of the world's largest producers of barite. The largest mining operations were in Guangxi and Guizhou, constituting collectively more than 75% of the national output. Significant barite resources exist in Fujian, Hubei, Hunan, and Shandong. Because of the low world price of petroleum, China's export of barite used as a drilling mud declined from 1.1 million tons in 1982 to 0.8 million tons in 1987. Close to 71% of China's shipments of barite was to the United States.

Bauxite.—China was a significant producer of both metallurgical and refractory bauxite from mining operations in Guangxi, Guizhou, Hunan, and Shandong. In 1987, exports of bauxite totaled 516,000 tons. Shipments to the United States included 148,000 tons of refractory-grade bauxite and 136,000 tons of metallurgical-grade bauxite.

Fluorspar.—China had historically been a major producer and exporter of fluorspar. Annual mine output may be more than 1 million tons. During 1986-87, exports of fluorspar have averaged more than 700,000 tons per year with about one-half of the annual shipments destined for Japan. In 1987, fluorspar shipments to the United

States were 38,377 tons valued at $2.9 million.

Magnesite.—China's largest magnesite mining operation was southeast of Anshan in Liaoning Province, which was perhaps the largest magnesite deposit in the world. Annual mine output of magnesite was estimated at 2 million tons. About one-quarter of the production was exported principally to Japan with lesser quantities to the Federal Republic of Germany. Shipments to the United States were 52,006 tons valued at $7.1 million.

Talc.—China was a major producer of talc with annual mine output estimated at 1 million tons. The three large talc mining bases were Long Sheng in Guangxi, Hai Cheng in Liaoning, and Hai Yang and Ye Xian in Shandong. In 1987, total exports of talc were 638,009 tons with more than one-half shipped to Japan. U.S. receipts of Chinese talc were small, valued at $563,000.

MINERAL FUELS

Energy development remained a key element in the national economy. The country's installed thermal-power electric generating capacity was 73 million kilowatts, accounting for 70% of the total power generating capacity. In 1988, 496 billion kilowatt-hours of electricity was produced, of which only 99.5 billion kilowatt-hours was from hydropower plants.

In addition to 1,500 small- and medium-size thermal powerplants, China had 75 plants each with a generating capacity of more than 250,000 kilowatts, and 6 powerplants each with an installed capacity of more than 1 million kilowatts. There were four large power grids each with a capacity of more than 10 million kilowatts. Thermal powerplants under construction mainly in the open coastal cities, major ports, and coal-producing areas have a combined generating capacity of more than 30 million kilowatts.

China imports large power-generating equipment. However, the power machinery plant in Harbin can produce thermal power generating units with capacities up to 600,000 kilowatts. The other power-generating equipment manufacturing facilities were in Beijing, Deyang, and Shanghai. The manufacturing bases for power transformers and transmission equipment were in Xi'an and Shenyang.

China's plans for nuclear power generation were minimal. Construction of a 300-megawatt plant at Qinshan in Hangzhou Bay was under way. Startup of the nuclear powerplant with two 900-megawatt reactors at Daya Bay in Guangdong was expected in 1992.

There were four experimental stations for wind-driven generators in China—Beijing, Jiangsu, Nei Monggol, and Zhejiang. Wind power generators were an effective means to ease power shortages in pastoral and remote areas. There were about 10,000 sets of 50-watt to 100-watt wind power generators in use in Nei Monggol. An 800-kilowatt wind power station, the largest in China, was in operation on an island off Fujian.

Two types of 3,000-watt wind power generators to be used in north and south China have passed technical appraisal and were undergoing further testing. In addition, the design of a 200-kilowatt generator had been completed. China's potential wind power energy exceeds 1 billion kilowatts, of which 160 million kilowatts was considered of harnessable value. China's utilization of other nonconventional energy sources included geothermal steam, biogas, and animal chips.

Coal.—China's premier energy source was coal, which accounts for 76% of all fuel consumption. Hence, the development of the coal industry was given high priority. China had large coal resources with verified reserves in excess of 800 billion tons. The verified reserves in Shanxi and Nei Monggol alone accounted for more than 50% of the nation's total. There were also large coal reserves in Anhui, Guizhou, Ningxia, and Shaanxi.

In 1987, there were 27 new mines that went into operation, raising coal production capacity by 24 million tons. Total mine output of coal was 925 million tons, an increase of 6% over production in 1986. The target for increasing coal production was 25 million tons per year in the present economic plan and in the ensuing 5-year plan, which ends in 1995. At yearend 1995, annual coal production capacity was expected to reach 1.1 billion tons. Smaller subsequent increases in annual production capacity were planned, so that by the year 2000, coal production would reach 1.2 billion tons per year.

The largest coal mine in China was at Antaibao, in Pinglu and Shuoxian Counties in the Province of Shanxi. This surface mine was a joint venture between Island Creek of China Coal Ltd. (52.5%), a subsidiary of Occidental Petroleum Corp. of the United States, and Pingshuo First Coal Corp. (47.5%). The mine was developed with

a total investment of $650 million. It covers 18.5 square kilometers and contains coal reserves of 450 million tons in eight seams; three seams were currently being mined. The mine was designed to produce 15 million tons of raw coal per year, which would yield 12 million tons of marketable coal—9.4 million tons for export and 2.6 million tons for domestic use. The coal preparation plant had four independent automated systems, each capable of washing 750 tons of coal per hour.

The transportation of coal from the Antaibao Mine to the Port of Qinhuangdao on the shore of Bohai Bay, some 890 kilometers east, will be by rail. The modern rail link would provide low cost transportation for the coal. A new single rail line had been completed, which would be electrified and double-tracked by 1989. The coal facilities at the port will also be upgraded by early 1989 to accommodate a 1.5-million-ton stockpile and a 30-million-ton-per-year throughput, making it the largest coal terminal in China.

Development of China's largest coalfield was in progress at Shenfu in the northern tip of Shaanxi Province. The verified reserves at Shenfu total 150 billion tons, covering an area of 13,000 square kilometers. Shenfu had high-quality coal with low ash, sulfur, and phosphorus content. Large coal seams lie near the surface, facilitating extraction. A 169-kilometer-long railway line was being constructed to link the mine with Baotao, Nei Monggol. Upon completion in 1988, the railway would transport 10 million tons of coal annually. Also under construction were auxiliary projects such as highways, bridges, and infrastructure for housing, commercial facilities, and telecommunications.

New coal mines under construction in China have a combined annual production capacity of 140 million tons. In addition, 77 state-owned coal mines were being modernized by upgrading production technology and equipment. Large mines newly commissioned and in full production included Zhenchengdi, Shanxi (annual production capacity of 4.5 million tons); Yangquan No. 2, Shanxi (4.4 million tons); Duerping, Shanxi (3.0 million tons); and Nanshan, Heilongjiang, (2.4 million tons).

There were more than 60,000 local coal mines, which accounted for more than 50% of the national output. In state-owned mines, 50% of the coal was mined by machines in the large mines. The national capacity for coal washing was minimal at 140 million tons.

China exported 16 million tons of high-quality coal to Japan, North Korea, the Philippines, France, Indonesia, Belgium, Denmark, Hong Kong, and other countries. The origin of exported coal included the mines at Datong, Huaibei, Kailuan, and Zaozhuang. Most of the coal was shipped from the Ports of Lianyungang, Shijiushuo, and Qinhuangdao. Under the seventh 5-year plan (1986-90), coal exports were to total 100 million tons.

Petroleum and Natural Gas.—In 1987, production of crude oil totaled 978 million barrels. The bulk of the output was from onshore wells; less than 1% was from offshore production. The Daqing Oilfield in Heilongjiang, China's largest oil-producing base, produced 409 million barrels, or 40% of the national output, followed by Shengli Oilfield in Hebei with 219 million barrels, and Liaohe Oilfield in Liaoning with 80 million barrels. Most of the remaining production was from oilfields in Dagang, Huabei, Junggar, and Zhongyuan. More than 7 billion barrels of oil reserves were added to the national total as a result of new discoveries in east China—Daqing, Shengli, Liaohe, Zhongyuan, Dagang—and other parts of the country including Xinjiang, Qinghai, Gansu, Nei Monggol, and Guangxi. The small production offshore was from two operations in Bohai (Weizhou and Beibu) and an operation at Wei in Nan Hai. Three oil-bearing structures were discovered in the Gulf of Liaodong. Oil and gas discoveries were also made in Liaodong, at the mouth of the Pearl River, and in Bohai. A large, deep gasfield was discovered on the banks of the Huang He, and new gas reserves were reported in eastern Sichuan. In addition, fields with more than 175 billion cubic feet of gas reserves have been discovered in Yinggehai and in the Tarin Basin in Xinjiang. China's reserves of natural gas were estimated to be more than 700 trillion cubic feet. The production of natural gas in 1995 was expected to double the present output level.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Chinese renminbi (RMB) to U.S. dollars at the rate of RMB3.72=US$1.00 for 1987.

[3]Beijing Review (Beijing). Communique on the Statistics for 1987 Socio-Economic Development. V. 31, No. 10, Mar. 7, 1988, pp. 1-8.

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The Mineral Industry of Colombia

By H. Robert Ensminger[1]

Colombia is richly endowed with energy resources, primarily coal, hydropower, natural gas, and petroleum. Recent developments have altered the country's energy trade balance from one of importation to exportation. The dramatic increase of fossil-fuel exports has been due largely to the emergence of coal as well as the resumption of crude oil exports. The El Cerrejon coal operation has continued to show increased production yearly since its inauguration in 1984.

The economy did well in 1987 with the gross domestic product (GDP) reaching $34.5 billion[2] in terms of current prices. This represented a real growth of 6% versus the 5% growth of 1986. The inflation rate for 1987 was in excess of 20%, which was high for Colombia. Some foreign debt rescheduling operations occurred involving banks and major companies such as Cerro Matoso S.A., the nickel mining company, and Cementos Samper S.A.; however, a wholesale rescheduling of external public and private debt did not transpire.

Until recently, the nonenergy mineral sector has not been an important segment of the economy, but the sharp rise in international nickel prices, in concert with a major revival in gold mining plus the development of other nonfuel mineral resources, may cause this sector to become much more important in the ensuing years.

Columbia's mineral export picture showed marked gains relative to the traditional coffee exports. The combined value of crude and fuel oil exports doubled relative to those of 1986. The export of nonenergy minerals increased 37.3% over that of 1986. Exports other than coffee accounted for 60% of the total exports in 1987 compared with 40% in 1986. For the first time since 1976 petroleum was a significant export of Colombia.

Despite Colombia's reputation as one of the best managed economies in Latin America, private foreign investors remained wary over investment risks, principally because of domestic violence. In the past 10 years, the largest foreign investments have been in petroleum, coal and nickel projects, but these huge initial investments are unlikely to be repeated in the near future. The Government attempted to promote interest in other sectors of the mineral industry and worked to improve trade and investment with the Asian-Pacific Basin. Closer trade ties with Japan have been discussed, and South Korean investment in the Conastil shipyard was on schedule.

The Government made new moves in 1987 to greatly liberalize foreign investment regulations. Important steps were taken to lessen the state's role as entrepreneur and to actively encourage more private investment. These steps included tax reforms, especially incentives for investment in petroleum and mining, and the encouragement of 100% foreign ownership in petrochemicals. The Government officially began steps to make private the 16 industrial firms in which the state has a share through the Instituto de Fomento Industrial (IFI). Foreign companies were encouraged to apply for licenses to mine gold in the Guianía region as the Government became interested in exploiting the potential of the area. The Guainía gold region is in the eastern part of Colombia near the Brazilian and Venezuelan borders.

Empresa Colombiana de Petróleos (ECOPETROL), the state oil company, initiated a 5-year exploration program that calls for drilling 23 wildcat wells annually compared

with 4 or 5 wells per year in the recent past. Colombia also began adopting measures with a view toward maintaining the exploration rate of associated private companies. the first time, plans were made to open large tracts in the Pacific coast area, both inland and offshore.

PRODUCTION

Production of crude petroleum in 1987 increased by 27% over that of 1986. This large increase in production placed Colombia fourth among the largest crude petroleum producers in Latin America after Mexico, Venezuela, and Brazil. The large increase in production has enabled Colombia to increase dramatically its exports of petroleum. Colombia also increased its production of coal by 38% over that of 1986. The production levels for coal were projected to reach 18.5 million tons for 1988 and 21.6 million tons for 1989.

Colombia, the ninth largest gold producer among the market economy countries and second largest in Latin America after Brazil, saw its gold production decrease by 51% less than that of 1986, which was a record low. The decrease was due partly to guerrilla attacks, but mainly to the cessation in midyear of the premium paid by the Central Bank for gold purchases. Consequently, the already rampant smuggling increased considerably and official production figures were in reality only figures for gold sold to the Central Bank.

During the year, Carbones de Colombia S.A. (CARBOCOL) released ambitious plans to become the world's largest steam coal and specialized coal supplier to international markets by the year 2000. The new program involves the development of major, steam-coal surface mines. The five new mines were to be near shipping routes on the Caribbean coast and in a 400-square-kilometer zone around El Cerrejon in the Guajira.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS					
Aluminum, bauxite	560	560	--	--	--
Copper, mine output, Cu content	162	234	--	--	--
Gold, troy ounces	416,517	730,670	1,142,385	1,285,878	853,468
Iron and steel:					
Iron ore and concentrate, thousand tons	456	441	439	523	615
Pig iron, do.	241	271	246	319	320
Ferroalloys: Ferrosilicon[e]	1,200	1,200	1,200	1,200	1,200
Steel, crude, thousand tons	482	499	570	607	615
Semimanufactures, hot-rolled, do.	374	412	468	512	263
Lead:					
Mine output, Pb content	154	51	82	202	158
Refined (secondary)[e]	3,000	3,000	3,000	4,000	4,000
Nickel:					
Mine output, Ni content	17,457	21,885	15,434	[r e]22,600	[e]25,200
Ferronickel, Ni content	13,060	17,064	11,800	[e]18,600	[e]20,700
Platinum-group metals, troy ounces	10,302	10,106	11,650	14,368	20,528
Silver	132,392	153,445	168,770	187,188	160,277
Zinc, mine output, Zn content	--	--	2,000	6,000	--
INDUSTRIAL MINERALS					
Asbestos[2]	5,400	9,982	12,435	[e]13,000	[e]13,000
Barite	3,839	3,340	5,050	4,198	4,189
Cement, hydraulic, thousand tons	4,721	[r]5,215	[r]5,394	6,011	5,965
Clays: Kaolin	1,010,543	938,307	1,041,151	1,155,267	1,221,000
Diatomite[e]	630	630	630	630	630
Feldspar	31,400	32,000	34,308	35,722	33,760
Gypsum, thousand tons	238	260	250	295	302
Lime, hydrated and quicklime[e], do.	1,300	1,300	1,300	1,300	1,300
Magnesite[e]	1,600	1,600	1,600	[3]14,936	15,000
Nitrogen: N content of ammonia	101,900	93,700	99,400	[e]100,000	[e]100,000
Phosphate rock	16,944	11,480	24,249	28,626	34,000
Precious and semiprecious stones: Emerald[4], carats	1,011,345	394,181	337,950	634,561	886,551

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
INDUSTRIAL MINERALS —Continued					
Salt:					
Rock thousand tons	271	271	236	227	205
Marine do.	423	664	494	501	450
Total do.	694	935	730	728	655
Sodium compounds, n.e.s.: Sodium carbonate	118,290	129,440	113,209	112,920	e125,000
Stone and sand:					
Calcite	6,454	4,575	3,107	5,334	5,334
Dolomite thousand tons	12	15	15	14	33
Limestone do.	10,685	11,565	11,756	e12,000	e12,000
Marble	15,500	15,171	16,993	19,568	17,500
Sand excluding metal-bearing	507,000	521,578	511,587	516,215	602,400
Sulfur:					
Native (from ore)	31,476	36,245	41,374	36,038	41,490
Byproduct, from petroleum	5,530	10,430	9,790	e10,000	e11,000
Total	37,006	46,675	51,164	e46,038	e52,490
Talc, soapstone, pyrophyllite	6,639	6,785	8,611	9,013	11,927
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[e]	18,000	18,000	18,000	18,000	18,000
Coal:					
Metallurgical thousand tons	593	603	618	630	759
Steam do.	4,460	6,034	9,088	11,540	13,835
Total do.	5,053	6,637	9,706	12,170	14,594
Coke, all types[e] do.	550	550	550	550	600
Gas, natural: Gross million cubic feet	184,950	182,100	182,700	e185,000	e190,000
Natural gas liquids:[e]					
Propane thousand 42-gallon barrels	2,800	2,840	2,840	2,840	2,900
Butane do.	600	600	600	600	650
Natural gasoline do.	800	800	800	800	850
Total do.	4,200	4,240	4,240	4,240	4,400
Petroleum:					
Crude do.	55,488	61,153	64,352	110,714	147,843
Refinery products:					
Gasoline:					
Aviation do.	423	317	342	313	e350
Motor do.	21,152	22,916	21,432	24,589	e26,000
Jet fuel do.	4,140	3,487	3,651	3,829	e4,000
Kerosene do.	2,246	2,017	2,156	2,147	e2,150
Distillate fuel oil do.	10,367	10,507	11,150	11,152	e11,200
Residual fuel oil do.	20,257	20,027	19,825	21,017	e22,000
Lubricants[e] do.	657	657	657	730	750
Liquefied petroleum gas (propane) do.	3,388	3,641	3,702	2,782	e2,800
Asphalt and bitumen do.	981	967	926	973	e1,000
Refinery fuel and losses and unspecified products do.	1,138	1,208	1,029	1,915	e2,100
Total do.	64,749	65,744	64,870	69,447	e72,350

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through Aug. 1988.
[2]Startup of open pit asbestos mine was in 1981.
[3]Reported figure.
[4]Based on registered exports by the Banco de la República.

TRADE

The total value of exports in 1987 was $5.1 billion, about the same level as that of 1986. Coffee exports decreased by 39%, fossil fuel exports increased 95%, and nontraditional exports increased 19%. Fossil fuels composed 31.7% of the total exports for 1987 while "new exports" made up 33%. Non-fossil-fuel mineral exports increased 37.3% in 1987.

In 1986, Colombia exported crude petroleum for the first time since 1975. In 1987, the crude petroleum exports exceeded the 1986 total of 31.3 million barrels by 60%. Colombia's total petroleum product exports, which included primarily residual fuel oil and other refined petroleum products, were estimated at approximately $476 million.

Exports of coal increased from $224 mil-

lion in 1986 to $269 million in 1987. Practically all of the exported coal came from the Cerrejon Norte Mine. CARBOCOL exported 4.6 million tons and International Colombia Resources Corp. (INTERCOR), a subsidiary of Exxon Corp., 3.7 million tons. Europe received 81% of the coal exports, the Western Hemisphere 12%, and the Far East the remainder. Colombia's steam coal exports will reach approximately 8% of the total world trade market by the end of the 1980's. Colombia's total coal exports were projected to reach 21 million tons by the mid-1990's.

Emerald exports valued at $47 million increased by 38% over that of 1986, while cement exports increased by 12% to $48 million.

The six mineral-related items listed below represent 35% of all exports in 1987, compared with a 12% share in 1982 when crude oil exports were not included. The values of the mineral-related items were as follows, in million dollars:

Commodity	1984	1985	1986	1987[p]
Crude oil	--	--	320	884
Fuel oil	444	407	284	476
Coal	59	151	224	269
Ferronickel	81	53	63	70
Cement	38	46	43	48
Emeralds	31	25	34	47
Total	653	682	968	1,794
Total exports	3,469	3,763	5,008	5,058

[p]Preliminary.

Table 2.—Colombia: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1984	1985	Destinations, 1985	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	--	6	--	All to Venezuela.
Metal including alloys:				
Scrap	64	82	82	
Semimanufactures	49	42	--	Ecuador 24; Panama 15; Venezuela 2.
Copper:				
Ore and concentrate	894	300	--	All to Japan.
Metal including alloys, semimanufactures	6	6	--	Panama 3; Venezuela 3.
Iron and steel: Metal:				
Pig iron, cast iron, related materials	1	1	--	All to Guatemala.
Ferroalloys	33,938	28,548	1,395	Netherlands 19,952; France 6,477.
Semimanufactures:				
Bars, rods, angles, shapes, sections	176	730	--	All to Venezuela.
Universals, plates, sheets	750	20	20	
Hoop and strip	18	20	--	All to Panama.
Wire	19	122	--	Venezuela 73; Peru 32, Dominican Republic 14.
Tubes, pipes, fittings	726	199	70	Panama 75; Haiti 36.
Castings and forgings, rough	212	332	--	Venezuela 331; Ecuador 1.
Lead:				
Ore and concentrate	620	198	--	All to Belgium-Luxembourg.
Metal including alloys, semimanufactures	2	--		
Nickel:				
Metal including alloys, semimanufactures	1	475	--	All to Japan.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$8,930	$11,625	$11,625	
Silver:				
Ore and concentrate[2] do.	$341	$217	--	All to Sweden.
Metal including alloys, unwrought and partly wrought do.	$488	$518	$80	Panama $438.
Tin: Metal including alloys:				
Scrap	2	--		
Semimanufactures value, thousands	--	$12	$12	
Zinc: Oxides	105	46	--	Guatemala 36; Costa Rica 5; Honduras 5.
Other: Oxides and hydroxides	22	13	--	All to Venezuela.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	6	--		
Grinding and polishing wheels and stones value, thousands	$23	$4	--	Ecuador $2; Costa Rica $1; Guatemala $1.

See footnotes at end of table.

Table 2.—Colombia: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1984	1985	Destinations, 1985	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Cement	645,250	849,974	642,699	Haiti 72,777; Suriname 56,802.
Chalk	504	153	20	Ecuador 61; Trinidad and Tobago 54.
Clays, crude	84	1,586	--	Venezuela 1,086; Ecuador 500.
Diamond: Gem, not set or strung value, thousands	--	$29	$3	Japan $26.
Feldspar, fluorspar, related materials	--	10	--	All to Venezuela.
Fertilizer materials: Manufactured:				
Ammonia	12,970	15,028	3,519	France 5,011; Belgium-Luxembourg 3,998.
Nitrogenous	--	35	--	All to Ecuador.
Unspecified and mixed	36	31,696	--	Venezuela 23,110; El Salvador 8,549; Ecuador 37.
Gypsum and plaster	76	61	--	All to Ecuador.
Magnesite, crude	21	--		
Precious and semiprecious stones other than diamond: Natural value, thousands	$24,783	$25,194	$2,192	Japan $22,072; Switzerland $724.
Salt and brine	--	316	--	All to Japan.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	50	--		
Sulfate, manufactured	547	450	--	Guatemala 402; Brazil 27; Venezuela 10.
Stone, sand and gravel: Sand other than metal-bearing	125	113	--	All to Ecuador.
Sulfur:				
Elemental, crude including native and byproduct	3,418	1,370	--	Ecuador 1,233; Panama 105; Guatemala 32.
Sulfuric acid	1,050	--		
Talc, steatite, soapstone, pyrophyllite	240	304	--	All to Venezuela.
Other:				
Crude	765	604	--	All to Ecuador.
Slag and dross, not metal-bearing	--	19	--	All to Venezuela.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	63	63	--	All to Ecuador.
Carbon black	3,887	3,345	--	Ecuador 2,561; Chile 784.
Coal: All grades excluding briquets	721,242	3,165,689	577,313	Netherlands 465,789; Finland 383,184.
Coke and semicoke	55,068	34,357	--	Venezuela 23,190; Cuba 7,186; Netherlands 2,000.
Petroleum refinery products:				
Gasoline, motor 42-gallon barrels	2,159	731	NA	Guatemala 9; unspecified 722.
Mineral jelly and wax do	--	11,679	9,594	Netherlands 1,598; Italy 480.
Kerosene and jet fuel do	756,222	971,238	NA	NA.
Distillate fuel oil do	37,509	27,900	NA	NA.
Lubricants do	602	2,863	--	Nicaragua 2,233; Peru 294; Ecuador 175.
Residual fuel oil thousand 42-gallon barrels	16,515	18,548	9,891	Netherlands Antilles 3,103; Bahamas 1,701.
Bitumen and other residues 42-gallon barrels	--	34,106	34,106	
Bituminous mixtures do	30	242	--	Ecuador 176; Panama 48; Guatemala 12.

NA Not available.
[1]Table prepared by H. D. Willis.
[2]May include other precious metals.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS				
Alkali and rare-earth metals	5	5	5	
Aluminum:				
Ore and concentrate	4,067	8,738	8,343	West Germany 199; Brazil 114.
Oxides and hydroxides	4,426	3,607	37	West Germany 2,970; United Kingdom 418; Canada 182.
Metal including alloys:				
Unwrought	17,977	11,670	94	Venezuela 5,457; Yugoslavia 3,066; Canada 2,196.
Semimanufactures	6,639	5,522	1,981	Venezuela 2,585; Ecuador 361.
Chromium: Oxides and hydroxides	72	161	102	West Germany 41; Spain 8.
Cobalt: Oxides and hydroxides	5	4	4	
Copper: Metal including alloys:				
Unwrought	2,643	2,414	34	Peru 1,981; Belgium-Luxembourg 374.
Semimanufactures	13,628	16,349	326	Chile 7,184; Belgium-Luxembourg 2,696; Mexico 1,195.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	121	392	92	Peru 200; France 98.
Metal:				
Scrap	43,587	58,094	33,462	Netherlands Antilles 17,002; Panama 7,471.
Pig iron, cast iron, related materials	12,206	1,515	184	Brazil 1,296; West Germany 33.
Ferroalloys:				
Ferromanganese	8,009	4,982	107	Brazil 4,083; Mexico 653.
Unspecified	3,703	4,475	109	Brazil 1,939; Chile 1,618; Mexico 619.
Steel, primary forms	27,457	16,748	6,161	Venezuela 5,193; Japan 2,503.
Semimanufactures:				
Bars,rods,angles,shapes, sections	62,736	35,357	1,498	Japan 10,430; France 6,960; United Kingdom 4,863.
Universals, plates, sheets	304,985	284,031	7,961	Japan 176,276; France 15,870; West Germany 15,433.
Hoop and strip	6,559	6,059	256	United Kingdom 3,475; Japan 1,222; France 457.
Rails and accessories	3,312	678	83	Poland 408; United Kingdom 160.
Wire	3,583	3,610	115	Brazil 1,015; United Kingdom 767; Belgium-Luxembourg 677.
Tubes, pipes, fittings	126,670	269,540	22,680	Japan 156,119; West Germany 35,177.
Castings and forgings, rough	752	555	33	Spain 208; Peru 204; Belgium-Luxembourg 82.
Lead:				
Oxides	1,564	1,403	1	Peru 1,267; Mexico 135.
Metal including alloys:				
Unwrought	618	797	--	Peru 657; Mexico 90; Denmark 50.
Semimanufactures	17	22	3	United Kingdom 10; West Germany 9.
Magnesium: Metal including alloys:				
Unwrought	34	64	51	Norway 10; West Germany 3.
Semimanufactures	32	49	49	
Manganese:				
Ore and concentrate, metallurgical-grade	3,397	2,303	--	Mexico 2,300, Netherlands 3.
Oxides	763	651	5	Brazil 525; Spain 68; Japan 32.
Mercury 76-pound flasks	928	1,102	638	Spain 203; West Germany 87.
Molybdenum: Metal including alloys, all forms	1	14	12	Sweden 1.
Nickel:				
Ore and concentrate	14	--		
Metal including alloys:				
Scrap	10	5	--	All from Canada.
Unwrought	309	149	36	Canada 98; Finland 6.
Semimanufactures	148	177	58	Canada 50; France 33.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$37	$45	$4	West Germany $25; Netherlands $14.
Silver: Metal including alloys, unwrought and partly wrought do.	$27	$82	$43	Canada $23; Italy $12.
Tin: Metal including alloys:				
Unwrought	299	319	--	Mainly from Bolivia.
Semimanufactures	64	8	2	Bolivia 5; West Germany 1.
Titanium: Oxides	344	506	177	West Germany 159; United Kingdom 97.
Tungsten: Metal including alloys, all forms	1	--		

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS —Continued				
Uranium and thorium: Metal including alloys, all forms value, thousands	$20	$8	$8	
Zinc:				
Oxides	50	64	4	Peru 41; West Germany 19.
Metal including alloys:				
Unwrought	15,698	14,945	139	Peru 13,987; Canada 385; Mexico 349.
Semimanufactures	168	244	138	Norway 53; Costa Rica 23.
Other:				
Ores and concentrates	450	496	22	United Kingdom 315; Netherlands 158.
Oxides and hydroxides	130	103	47	West Germany 45; Italy 10.
Base metals including alloys, all forms	66	119	46	Brazil 22; Bolivia 21.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	198	229	201	West Germany 10; Switzerland 8.
Artificial:				
Corundum	984	982	22	Brazil 860; West Germany 58; Italy 30.
Silicon carbide	(2)	--		
Grinding and polishing wheels and stones	20	30	19	Italy 7; West Germany 3.
Asbestos, crude	11,970	14,283	232	Canada 13,001; Italy 990.
Barite and witherite	47	9,020	5,020	Peru 4,000.
Boron materials:				
Crude natural borates	1,472	1,860	84	Peru 1,774; West Germany 2.
Oxides and acids	424	444	233	Peru 151; West Germany 27.
Cement	4,851	1,227	626	France 534; Italy 51.
Chalk	195	537	5	Switzerland 471; United Kingdom 60.
Clays, crude	16,032	24,631	18,861	Argentina 5,117; Peru 574.
Diamond:				
Gem, not set or strung value, thousands	$6	$66	$66	
Industrial stones do	$2	--		
Diatomite and other infusorial earth	561	1,025	604	Mexico 419; United Kingdom 2.
Feldspar, fluorspar, related materials	374	330	270	United Kingdom 21; Netherlands 20.
Fertilizer materials: Manufactured:				
Ammonia	10,588	18,069	1	Venezuela 18,040; West Germany 27.
Nitrogenous	212,591	256,492	105,120	Venezuela 60,937; Cayman Islands 30,986.
Phosphatic	12,112	13,837	13,837	
Potassic	164,963	173,810	74,663	East Germany 58,342; Spain 28,188.
Unspecified and mixed	125,350	147,791	147,096	West Germany 303; Belgium-Luxembourg 252.
Graphite, natural	36	369	47	Canada 301; West Germany 16.
Gypsum and plaster	26,554	62,057	263	Jamaica 46,863; Spain 14,907.
Magnesite, crude	736	1,402	37	Canada 551; Austria 433; West Germany 181.
Mica:				
Crude including splittings and waste	150	117	88	France 26; Switzerland 1.
Worked including agglomerated splittings	41	8	1	Spain 6; unspecified 1.
Nitrates, crude	--	30	--	All from Netherlands.
Phosphates, crude	37,425	40,608	40,608	
Pigments, mineral: Iron oxides and hydroxides, processed	1,467	2,110	58	West Germany 1,763; Mexico 86; Argentina 71.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$5	$16	$15	Denmark $1.
Synthetic do	--	$2	$1	West Germany $1.
Salt and brine	73	196	61	West Germany 73; Ecuador 62.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	12	6,498	6,486	West Germany 7; Belgium-Luxembourg 5.
Sulfate, manufactured	12,289	10,709	141	Mexico 6,381; Finland 3,060; West Germany 493.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	3,213	2,531	1	Peru 2,422; West Germany 46; Switzerland 32.
Worked	149	30	--	All from Italy.
Dolomite, chiefly refractory-grade	8,360	5,403	2,459	Belgium-Luxembourg 2,494; West Germany 345.
Gravel and crushed rock	1,968	1,800	46	Venezuela 1,667; United Kingdom 65.
Limestone other than dimension value, thousands	--	$1	$1	
Quartz and quartzite	(3)	58	--	All from Japan.
Sand other than metal-bearing	1,775	2,201	1,023	Brazil 1,178.
Sulfur:				
Elemental:				
Crude including native and byproduct	38,002	20,366	20,366	
Colloidal, precipitated, sublimed	186	222	222	
Sulfuric acid	22	64	24	West Germany 31; France 6.
Talc, steatite, soapstone, pyrophyllite	1,618	2,313	1,723	Italy 409; West Germany 90.
Other: Crude	10,557	7,022	3,733	Mexico 1,789; United Kingdom 1,047.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	83	136	136	
Carbon black	835	1,863	449	Venezuela 1,098; West Germany 286.
Coal:				
Lignite including briquets	60	110	110	
All grades excluding briquets	7	10	--	All from France.
Coke and semicoke	2	--		
Petroleum:				
Crude, thousand 42-gallon barrels	10,464	7,066	--	Venezuela 5,427; Ecuador 1,317; Panama 322.
Refinery products:				
Liquefied petroleum gas 42-gallon barrels	139	70	--	All from France.
Gasoline, motor thousand 42-gallon barrels	5,647	9,348	2,490	Mexico 3,007; Peru 1,326.
Mineral jelly and wax 42-gallon barrels	150,561	9,963	2,652	United Kingdom 3,290; Netherlands 1,779.
Kerosene and jet fuel, do.	124	163	124	West Germany 39.
Lubricants, do.	163,891	246,743	100,464	Venezuela 77,532; Netherlands Antilles 55,664.
Bitumen and other residues do.	5,018	2,382	18	Venezuela 2,364.
Bituminous mixtures, do.	491	291	164	Venezuela 97; United Kingdom 30.
Petroleum coke, do.	1,254	919	919	

[1]Table prepared by H. D. Willis.
[2]Revised to zero.
[3]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Copper.—Development work began in midyear on the El Lobre deposit near Medellin where Minas El Lobre is involved in a joint venture with the Japanese companies Nittetsu Mining and C. Itoh. In 1987, construction was to begin on a $20 million mining and milling facility with an annual capacity of 96,000 tons of copper concentrate. The project is scheduled to supply 14,000 tons per year to Nittetsu by mid-1989. At midyear, reserves were estimated to be 1 million tons of 4.7% copper.

Gold.—In 1987, Colombia was the ninth largest gold producer in the market economy countries and ranked second to Brazil in Latin America; however, the official registered production was 48,200 troy ounces below the figure for 1986. More than 80% of the gold produced in 1987 came from small-scale alluvial workings in the Departments of Tolima, Caldas, Antioquia, and Chocó, all to the west of the Andean Divide. Seventy-four percent of production came from the Department of Antioquia and 8% from

Chocó. Small- and medium-size mines contributed 94% of the gold produced. Approximately 60% of the total production came from alluvial deposits. In 1987, the large-scale gold-mining enterprises produced approximately 6% of the total gold production. Of special significance is that there were only three large-scale gold-mining enterprises operating in 1986. During the year, the Instituto Nacional de Investigaciones Geológico-Mineras (INGEOMINAS) and Empresa Colombiana de Minas (ECOMINAS) carried out geological surveys of potential gold-producing areas.

In 1987, the Government created Sociedad Minera del Guainia (SMG) to explore and develop the newly discovered and potentially rich Guainia Goldfield in the far eastern region of Colombia bordering Brazil. The SMG was established with an initial capitalization of approximately $18 million. ECOMINAS contributed 50% (in the notational form of a value attributed to the gold-containing area that ECOMINAS controls), and 50% was contributed in cash by the state oil company, ECOPETROL, to pay for exploration, salaries, and other operating costs.

Foreign companies have shown considerable interest in the Guainia Goldfield, and a number of their representatives have made long helicopter flights to inspect the region. When the results of the geological studies have been published, licenses will be offered covering a two-stage development scheme. The first stage is to be a short period of more detailed exploration by the private companies, while the second stage will be for a full-production license, probably for a minimum period of 20 years.

Two general categories of gold deposits occur in Colombia: gold in veins (lodes) and gold in alluvial placers. In addition, there are some less significant deposits of disseminated gold. The principal regions for lode deposits are the central and western chains of the Andean Cordillera, a small area in the eastern chain (Santander), and the Sierra Nevada. The alluvial deposits primarily occur along the tributaries of the San Juan and Atrato Rivers, the western tributaries of the Magdalena River (Departments of Tolima and Huila), the river systems of the southwestern Pacific region, and the tributaries of the Lower Cauca and Nechi Rivers. Two new areas of great potential for alluvial gold, and possibly vein gold, are the Guainia and Traira Rivers in the Orinoco and Amazon regions of eastern Colombia.

Iron and Steel.—In 1987, in excess of 500,000 tons of iron ore was mined in Colombia, of which the preponderance was produced from the Paz del Rio deposit in the eastern Andes region. The Cerro Matoso area contains 17 million tons of reserves, which ECOMINAS plans to exploit in the near future.

The private financial group Ingenio Mayaguez of Valle del Cauca, owns the four largest semi-integrated steel companies in Colombia. It continued to expand and modernize its steelmaking facilities, thereby improving its operating efficiency substantially.

Nickel.—Initial production began at Cerro Matoso in 1982 but has been dogged ever since by technical difficulties, high costs, and for the most part, the low price of nickel. By January 1987, total losses exceeded $265 million. However, the problems appeared to have been largely overcome during the year. Early in 1987 the Government announced that it would assume the company's debts, and Cerro Matoso underwent a financial overhaul. In conjunction with buoyant nickel prices, the operation looked more viable at yearend as mine production reached an estimated 25,000 tons, and ferronickel export earnings rose to $70 million.

Other Metals.—Silver and platinum were produced in small quantities in 1987. Greenstone Resources of Canada, which operates the Oronorte gold-silver project, conducted feasibility studies on some of the 12 claims it owns in the Department of Antioquia.

Bauxite deposits containing an estimated 375 million tons of reserves were investigated in 1987. These deposits were found in the Departments of Antioquia, Cauca, Meta, Norte de Santander, Santander, and Valle del Cauca.

INDUSTRIAL MINERALS

In 1987, Colombia produced a wide range of industrial minerals including barite, clays, dolomite, feldspar, gypsum, limestone, magnesite, mica, phosphate rock, salt, sulfur, and talc. In the Pesca area of Boyaca, a phosphate rock deposit containing an estimated 10 million tons of reserves were under investigation. Additional deposits containing an estimated 14 million tons of phosphate rock reserves were also being studied.

In 1987, approximately 887,000 carats of emerald was mined in Colombia. This was the highest annual total mined since 1983,

and exceeded the 1986 total by 40%.

MINERAL FUELS

Coal.—Colombia's potential coal reserves of about 40 billion tons are the largest in Latin America (approximately 38% of the regional total), despite the fact that only 7 of the 35 coal basins have been surveyed adequately. Recent major investments have boosted Colombia into the league of large exporters with total coal export revenues reaching a record high of $269 million in 1987, compared with only $17 million earned in 1982. The preponderance of the coal deposits occur in the northwestern mountain chains, but there are significant deposits in the Atlantic coastal plain and an additional large deposit in the Llanos Orientales region. Of the surveyed deposits, 65% was composed of steam coal, 5% was coking coal, and 30% remained unclassified. Coal production rose by 20% in 1987, with El Cerrejón Norte accounting for most of the increase. The vast El Cerrejón coal deposit on the La Guajira Peninsula, Department of La Guajira, contains 14% of Colombia's known coal reserves and comprises the North, Central, and South Zones. El Cerrejón Norte, developed by CARBOCOL and INTERCOR since 1976, has become the largest surface coal mine in the world. El Cerrejón Norte, containing in excess of 3 billion tons of high-quality, noncoking, bituminous reserves, began production in its west pit in 1985, more than a year ahead of schedule.

Because of cash-flow problems, CARBOCOL was forced early in 1987 to offer a 49% share in its holdings in El Cerrejón Norte to a consortium of Japanese companies, headed by Japan Coal Development Co. Ltd. However, at yearend it was reported that CARBOCOL was nearing an agreement with ECOPETROL to take a 24.5% stake in the project—a politically acceptable solution to CARBOCOL's financial problems.

Compared with Polish, Australian, and United States coal producers, CARBOCOL remains one of the few coal producers opening new mines, increasing production, and selling its output at realistic prices. The company planned to increase El Cerrejón Norte output to 12 million tons in 1988.

In 1987, Colombia exported coal to 24 countries and opened new markets in Argentina, Brazil, Greece, Hong Kong, the Republic of Korea, Morocco, Portugal, and the United Kingdom. Denmark and France were Colombia's largest customers. Cerrejon coal washed in Belgium in 1986 yielded 0.7% ash, which aroused great interest in Europe and Asia. In addition, CARBOCOL attempted to interest the Japanese stock market in a special issue of "debt bonds" and wooed Tokyo banks into refinancing its large foreign debt.

CARBOCOL sold 120,000 tons to Taipower of Taiwan at yearend but had to postpone delivery as it was "sold out" of exporting coal until April 1988. In September, the company stated that it had already sold all of its 1987 production of 8.8 million tons from Cerrejon.

CARBOCOL's plan to reopen the El Cerrejon Central Zone Mine, closed since 1984 because of continuing losses in its previous 2 years of operation, did not come to fruition during the year.

During the year, CARBOCOL unveiled ambitious plans. A new program involves the development of major, steam-coal surface mines. Of the five new projects, the most advanced of these projects was La Loma in the Department of Cesar. With an initial capacity of 6 million tons per year, possibly being increased to 10 million tons per year after 1997, La Loma would export 4 to 6 million tons per year to the United States via the port of Santa Marta in the Department of Magdalena. Other projects in the new program were El Descanso near La Loma; San Luis, in the Department of Santander; Alto San Jorge and Montelibano in the Department of Cordoba; and La Jagua Coalfield in the Department of Cesar. El Cerrejon, La Jagua, and La Loma, all within a 250-square-kilometer area close to the Caribbean coast, make Colombia potentially one of the world's largest international suppliers of coal over the next decade. Colombia's production is projected to reach 21 million tons annually by the mid-1990's.

Natural Gas.—Plans to increase Guajira production were announced early in 1987. A 1,000-kilometer pipeline was planned to link this producing area with major population centers. The Minister of Mines and Energy announced that about 65 wildcat wells would be drilled in 1988. Two wells would be drilled offshore and seven or eight would be drilled in promising gas areas. More than 67% of Colombia's 113 billion cubic meters (4 trillion cubic feet) of natural gas reserves were in the northern portion of the Department of Guajira, but some reserves exist in the Departments of Magdalena and Meta.

Petroleum.—Crude petroleum production increased from an average of 302,139 barrels per day in 1986 to an average of 405,050 barrels per day in 1987. A production level

of 461,080 barrels per day was projected for 1988. It was reported that Colombia has an estimated 2.5-billion-barrel reserve of petroleum comprising 1.3 billion barrels of proven reserves and 1.2 billion barrels of inferred reserves. If no new fields were discovered, Colombia's production potential would decline between 25% and 50% by the year 2000.

Cravo Norte in the Llanos Basin, principally the Caño Limón Field, was developed with recordbreaking speed since its discovery in 1983. This included the drilling of more than 40 development wells, each to a depth in excess of 2,740 meters, in addition to the laying of an 800-kilometer, 24-inch pipeline capable of transporting 200,000 barrels per day. The new Caribbean shipping terminal of Coveñas was also established. Cravo Norte has recoverable reserves of excellent light crude (29.5 API) low in sulfur. Occidental Petroleum Corp. and Shell International are the joint partners under a 20-year-association contract with ECOPETROL.

Electric power is the key element in the supergiant Caño Limón oilfield development. Production and transportation of the crude petroleum depends on a major power-generating and distribution system. The largely British-built and operated central powerplant was begun in 1987. Petroleum produced from the nearby production facility is the prime source of fuel. Distribution lines to carry Caño Limón power to the main townships of the region were being installed, and by late 1989, the 230-kilovolt national grid is scheduled for connection to Caño Limón.

Several oil pipeline projects have been initiated to enable Colombia to meet its export targets. Work was begun on the Cravo Norte-Coveñas pipeline to expand its transport capacity to 300,000 barrels per day from 200,000 barrels per day. Work was also under way on a 100,000-barrel-per-day pipeline due for completion in mid-1988, which will carry crude oil from the eastern plains Casanare and Apiay structures to the Barrancabermeja refinery.

Increased production from Colombia's oilfields has brought renewed plans for new refining capacity in which both Petrobras Internacional S.A. (BRASPETRO) of Brazil and Petróleos Mexicanos (PEMEX) have shown an interest. Colombia has four operating refineries having a total charge capacity of 226,000 barrels per day of crude petroleum. The Barracabermeja refinery, Santander, and the Cartagena facility, Bolivar, produced 90% of the total output, while Orito, Putumayo, and Tibu, Norte de Santander, accounted for the remainder. The planned construction of a new refinery in the Magdalena River Valley would eliminate 15,000 barrels per day of gasoline imports; the two-phase construction would establish capacity of 60,000 barrels per day by 1993 and an additional 40,000 barrels per day thereafter.

NONMINERAL ENERGY SOURCE

Hydroelectric plants accounted for more than 70% of the 6,000 megawatts of installed generating capacity in Colombia. Ambitious plans to more than double this capacity by 1997 were scaled down because of the high cost and a surplus of generating capacity. Three new projects added approximately 810 megawatts to the total national capacity in 1987.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Colombian pesos (Col$) to U.S. dollars at the average rate of Col$242.6=US$1.00 for 1987.

The Mineral Industry of Cyprus

By Thomas O. Glover[1]

The mining and processing of 14 minerals, important to the economy of Cyprus in past years, remained virtually at the same level as in 1986. The value of minerals produced in 1987 rose a modest 4% over that produced in 1986. The industry continued to suffer from the depletion of known mineral reserves and the lack of new reserves.

The Cypriot gross national product (GNP) in 1987 was $3.8 billion,[2] showing a very healthy growth rate. However, the average inflation rate of 2.8% was more than twice the 1986 rate and the trade balance with the United States showed an increased deficit of $57 million compared with a $44 million deficit in 1986.

Cyprus remained divided for the 14th consecutive year with the Turkish Cypriots controlling the northern two-fifths and the Greek Cypriots controlling the southern three-fifths. Negotiations were undertaken to resolve the partition; however, no positive results were apparent. Presidential elections were scheduled for the southern sector in early 1988. Only the southern sector was considered in this chapter because there was little, if any, mineral production in the northern sector.

PRODUCTION AND TRADE

The production of minerals in Cyprus during 1987 registered gains for asbestos fiber, bentonite, industrial clays, crude gypsum, pyrites, and umber, ranging from 25% to 61% when compared with the 1986 production. The production of cement copper and celestite declined by 81% and 15%, respectively, when compared with the 1986 production. Unit prices for the mineral commodities declined in most instances except for bentonite and pyrites, which registered increases when compared with those of 1986. The value of all minerals produced in Cyprus was $77.2 million.

The mineral industry has suffered greatly from the depletion of chromite and copper ore bodies and the country's inability to discover new ones. Prospecting activities by the Cyprus Government and private companies continued; however, no economic ore bodies were discovered. The Government conducted its exploratory program for metallic and industrial minerals through its Geological Survey. The metallic minerals program concentrated on geological and geophysical exploration for massive sulfides in the Agia Marina-Vezakia, Mandres, and Stavrovouni-Menoyia areas, and started a drilling program with five holes completed. Investigations on chromite were completed during the first half of 1987. In the industrial minerals section, only limited exploration was carried out on strontium minerals.

A full customs union agreement was signed with the European Economic Community (EEC) in October 1987 to become effective January 1, 1988. All trade barriers would be dismantled during the next 15 years under the agreement. Under the new customs union, all customs duties and quotas for

industrial products and some agricultural products would be dismantled by 1997. The EEC was Cyprus' main trading partner, accounting for 54% of Cypriot imports and 28% of its exports. The agreement covered both sections of Cyprus, although only the Greek Cypriot Government signed it. The agreement was a step short of full membership for Cyprus in the EEC.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[p]
METALS					
Copper: Cement copper	2,088	2,290	2,130	1,188	193
INDUSTRIAL MINERALS					
Asbestos, fiber produced	17,288	7,429	16,360	13,011	18,070
Celestite, concentrates	--	--	1,400	7,365	6,300
Cement, hydraulic thousand tons	943	853	659	864	854
Clays, crude:					
Bentonite	32,000	32,400	52,000	55,000	79,600
Other:					
For brick and tile manufacture thousand tons	230	220	212	220	200
For cement manufacture do.	250	[e]250	[e]250	[e]250	[e]250
Total[e] do.	[3]480	470	462	470	550
Gypsum:					
Crude	32,000	22,100	16,000	30,000	45,700
Calcined	10,000	11,900	8,500	5,500	4,960
Lime, hydrated	8,500	7,380	7,730	7,452	6,890
Mineral pigments, umber	16,000	13,100	12,200	10,000	12,500
Pyrites	46,665	23,322	69,600	56,672	91,380
Salt, marine	--	7,399	10,013	6,051	--
Stone, sand and gravel:					
Crushed and broken stone:					
Havara (crushed limestone) thousand tons	4,500	3,560	2,800	2,500	2,360
Marble	90,000	87,500	80,000	75,000	80,000
Marl, for cement production	533,970	NA	NA	NA	NA
Unspecified building stone	500,000	450,000	343,000	280,000	285,000
Sand and aggregate thousand tons	4,100	4,075	4,450	4,370	4,200
Sulfur, S content of marketable pyrites	--	--	--	--	41,121
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Liquefied petroleum gas thousand 42-gallon barrels	227	218	172	239	[e]240
Gasoline do.	890	856	789	993	[e]990
Kerosene and jet fuel do.	468	463	248	272	[e]270
Distillate fuel oil do.	1,147	1,160	990	1,220	[e]1,200
Residual fuel oil do.	1,101	1,148	924	1,069	[e]1,070
Asphalt do.	165	174	145	165	[e]170
Refinery fuel and losses do.	207	201	145	152	[e]150
Total do.	4,205	4,220	3,413	4,110	[e]4,090

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

[1]Table includes data available through June 28, 1988.

[2]In addition to the commodities listed, a variety of other crude construction materials are produced, but available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Scrap	381	881	--	Netherlands 329; West Germany 198; Greece 155.
Semimanufactures	57	35	--	Lebanon 21; Egypt 7.
Copper:				
Matte and speiss including cement copper	1,665	1,148	--	West Germany 732; Spain 416.
Metal including alloys, scrap	573	365	--	Greece 194; Denmark 54; Belgium-Luxembourg 45.
Iron and steel: Metal:				
Scrap	14,062	13,309	--	Greece 6,917; Dubai 3,479.
Semimanufactures:				
Bars, rods, angles, shapes, sections	11	60	--	All to Syria.
Universals, plates, sheets	477	57	--	Belgium-Luxembourg 38; Syria 6; United Kingdom 6.
Wire	61	1	--	All to Libya.
Tubes, pipes, fittings	41	289	--	Greece 202; Libya 22; Algeria 20.
Lead: Oxides	201	--		
Zinc: Metal including alloys, scrap	110	22	--	West Germany 20; Denmark 2.
INDUSTRIAL MINERALS				
Asbestos, crude	16,680	11,781	--	Belgium-Luxembourg 2,064; Thailand 1,653; Iran 1,275.
Cement	64,877	349,994	--	Egypt 290,639; Nigeria 19,087; Poland 14,453.
Clays, crude: Kaolin including bentonite	12,537	18,164	--	United Kingdom 15,845; Libya 1,000; Egypt 900.
Diamond: Gem, not set or strung value, thousands	$240	$218	$35	Greece $55; Israel $52; Belgium-Luxembourg $43.
Gypsum and plaster	1,315	12,224	--	Lebanon 7,950; Egypt 2,650.
Pigments, mineral: Natural, crude	6,754	6,741	5,071	United Kingdom 668; Denmark 146.
Pyrite, unroasted	64,390	65,938	--	Italy 65,615.
Salt and brine	168	27	--	Oman 18; Bahrain 7.
Stone, sand and gravel: Dimension stone, worked value, thousands	NA	$293	--	Bahrain $219; Oman $62.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline, motor 42-gallon barrels	27,897	--		
Mineral jelly and wax do.	--	1,227	--	All to Saudi Arabia.
Kerosene and jet fuel do.	708,652	--		
Distillate fuel oil do.	77,271	--		
Lubricants do.	3,896	5,589	--	Greece 3,665; Israel 1,806.
Residual fuel oil do.	106,280	--		

NA Not available.
[1]Table prepared by Virginia A. Woodson.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Scrap	18	40	--	All from Sweden.
Unwrought	20	2,000	--	Canada 1,185; Greece 801.
Semimanufactures	3,679	2,477	3	Greece 876; United Kingdom 182; Israel 126.
Cobalt: Oxides and hydroxides value, thousands	$1	$2	--	Mainly from Netherlands.
Copper:				
Matte and speiss including cement copper	2	10	--	All from United Kingdom.
Metal including alloys:				
Scrap	92	75	--	All from Sweden.
Unwrought	74	43	--	All from United Kingdom.
Semimanufactures	947	1,140	16	United Kingdom 223; Greece 205; Spain 177.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel: Metal:				
Pig iron, cast iron, related materials	1,555	1,519	--	West Germany 1,000; Poland 519.
Steel, primary forms	14	--		
Semimanufactures:				
Bars, rods, angles, shapes, sections	83,825	93,866	--	Spain 41,668; Greece 22,761; United Kingdom 11,650.
Universals, plates, sheets	20,815	23,306	--	Greece 6,554; West Germany 5,220; Belgium-Luxembourg 2,189.
Hoop and strip	5,075	5,680	--	Greece 3,588; Austria 1,509.
Rails and accessories	79	88	(2)	Netherlands 54; Belgium-Luxembourg 27.
Wire	2,303	2,578	--	United Kingdom 839; Hungary 679; Belgium-Luxembourg 632.
Tubes, pipes, fittings	19,876	22,408	30	France 11,438; Greece 4,197; Italy 2,313.
Castings and forgings, rough	--	3	--	Italy 2; United Kingdom 1.
Lead:				
Oxides	127	206	--	United Kingdom 205.
Metal including alloys:				
Scrap	26	2	--	All from United Kingdom.
Unwrought	423	151	--	Italy 108; Netherlands 43.
Semimanufactures	681	716	--	United Kingdom 602; Netherlands 73; Lebanon 40.
Mercury value, thousands	$2	$4	--	West Germany $2; Italy $1.
Nickel: Matte and speiss	1	1	--	All from Spain.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$44	$108	$9	West Germany $86; United Kingdom $11.
Silver: Metal including alloys, unwrought and partly wrought troy ounces	221,346	275,533	(3)	United Kingdom 145,182; West Germany 93,062; Austria 21,645.
Titanium: Oxides	392	335	--	United Kingdom 159; Finland 101; West Germany 58.
Zinc:				
Oxides	7	53	--	West Germany 40; Netherlands 13.
Metal including alloys:				
Unwrought	13	78	--	Belgium-Luxembourg 70; Netherlands 5.
Semimanufactures value, thousands	$203	$121	--	Belgium-Luxembourg $68; Netherlands $37.
Other:				
Ores and concentrates	89	72	--	All from Australia.
Base metals including alloys, all forms	11	--		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	107	129	1	Greece 117; Italy 10.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$1	$1	--	Mainly from Belgium-Luxembourg.
Grinding and polishing wheels and stones do	$263	$345	$3	Italy $139; United Kingdom $46; Spain $32.
Asbestos, crude	455	224	--	Botswana 136; Zimbabwe 72.
Barite and witherite	--	2	--	All from West Germany.
Boron materials: Oxides and acids	--	2	--	West Germany 1.
Cement	14,210	16,099	--	Greece 6,575; Italy 5,019; United Kingdom 2,091.
Chalk	320	438	--	United Kingdom 294; Greece 113.
Clays, crude:				
Bentonite and kaolin	--	7,626	17	Greece 7,317; West Germany 82.
Unspecifed	4,957	--		
Diamond: Gem, not set or strung value, thousands	$1,240	$1,199	--	Belgium-Luxembourg $465; United Kingdom $313; Israel $244.
Diatomite and other infusorial earth	154	203	168	West Germany 32.
Feldspar, fluorspar, related materials	--	20	--	All from West Germany.
Fertilizer materials, manufactured:				
Ammonia	r46	25	--	Netherlands 15; United Kingdom 6.
Nitrogenous	r9,339	17,050	--	Hungary 6,191; Bulgaria 6,001; Romania 1,612.
Phosphatic	3,262	50	--	All from Romania.
Potassic	879	1,020	--	All from Israel.
Unspecified and mixed	28,982	29,456	29	Italy 16,295; Romania 7,885; Greece 3,405.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Graphite, natural	--	8	--	United Kingdom 2; unspecified 6.
Gypsum and plaster	21	25	3	United Kingdom 20.
Magnesite, crude	84	77	1	Netherlands 62; West Germany 10.
Mica: Crude including splittings and waste	16	9	--	Norway 6; United Kingdom 2.
Pigments, mineral: Iron oxides and hydroxides, processed	29	34	--	United Kingdom 23; Belgium-Luxembourg 6.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$462	$730	$1	West Germany $446; United Kingdom $61; Belgium-Luxembourg $55.
Synthetic do.	$99	$130	--	Switzerland $62; Belgium-Luxembourg $35; Hong Kong $8.
Salt and brine	718	1,221	--	Israel 428; United Kingdom 416; Netherands 293.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	3,152	872	--	France 487; West Germany 190; Netherlands 26.
Sulfate, manufactured	697	783	--	United Kingdom 273; West Germany 233; Italy 129.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	5,997	9,636	--	Italy 5,727; Greece 3,703.
Worked value, thousands	$598	$654	--	Greece $477; Italy $158.
Dolomite, chiefly refractory-grade	53	49	--	Norway 33; Greece 15.
Gravel and crushed rock	1,421	1,033	--	Italy 992.
Limestone other than dimension	--	11,515	--	All from Greece.
Quartz and quartzite	--	23	--	Zimbabwe 14; Italy 9.
Sand other than metal-bearing	666	569	--	West Germany 357; Belgium-Luxembourg 80.
Sulfur:				
Elemental:				
Crude including native and by-product	2,521	2,823	--	Greece 1,403; Lebanon 1,192.
Colloidal, precipitated, sublimed	--	1	--	All from United Kingdom.
Sulfuric acid	269	342	--	Greece 325.
Talc, steatite, soapstone, pyrophyllite	237	380	--	Greece 246; Norway 73.
Other: Slag and dross, not metal-bearing	--	72,709	--	Italy 52,547; France 20,142.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	235	106	--	All from Greece.
Carbon black	4	4	--	West Germany 3; United Kingdom 1.
Coal:				
Anthracite and bituminous	55,132	54,638	20,782	U.S.S.R. 33,840.
Briquets of anthracite and bituminous coal	11,031	68	10	West Germany 58.
Coke and semicoke	56	328	--	Belgium-Luxembourg 200; France 106.
Peat including briquets and litter	1,576	2,614	--	West Germany 2,136; Ireland 163; United Kingdom 158.
Petroleum:				
Crude thousand 42-gallon barrels	2,884	4,155	--	Iraq 2,374; U.S.S.R. 1,181.
Refinery products:				
Liquefied petroleum gas do.	337	278	--	Italy 103; Greece 61; Libya 52.
Gasoline do.	218	120	(2)	Saudi Arabia 60; Italy 59.
Mineral jelly and wax do.	NA	2	(4)	Mainly from Spain.
Kerosene and jet fuel do.	835	966	--	Italy 549; Greece 296.
Distillate fuel oil do.	408	461	--	Italy 183; Bulgaria 127; Iraq 67.
Lubricants do.	44	67	1	Belgium-Luxembourg 19; United Kingdom 18.
Residual fuel oil do.	1,419	2,841	(2)	Syria 830; Italy 753; Egypt 528.
Bituminous mixtures do.	3	5	(2)	Greece 3; United Kingdom 2.

[r]Revised. NA Not available.
[1]Table prepared by Virginia A. Woodson.
[2]Less than 1/2 unit.
[3]Unreported quantity valued at $12,000.
[4]Unreported quantity valued at $1,000.

COMMODITY REVIEW

METALS

Chromite.—Investigations relative to the Akapnou Forest area chromites were completed in the first half of 1987. A report was published on the findings. France's parastatal Bureau de Recherches Géologiques et Minières conducted the investigations. Of six holes drilled in 1987, only four intersected chromite lenses, which were only about 1 meter thick.

Copper.—Cement copper was produced from tailings at the Alestos and Skouriotissa Mines by an in situ leaching process. Production for 1987 was 193 tons of cement copper containing 41.61% copper that was valued at $70,252. The cement copper operation was owned by Hellenic Mining Co. Ltd. (Helco) of Cyprus.

Iron Pyrites.—Helco and Maconda Co. produced 91,380 tons of pyrites valued at $2.45 million. This represented a 61% increase in production and a 73% increase in total value from that of 1986. Maconda was a small mine in its second year of operation in 1987, producing and exporting 7,560 tons of high-grade pyrite. The ore body was small and known to exist many years prior to its exploitation.

INDUSTRIAL MINERALS

Asbestos.—The production of asbestos increased 15% in ore mined and 39% in fiber produced from that mined in 1986. The production of 18,070 tons of asbestos fiber was valued at $4.5 million. Asbestos sales ranked third in minerals sold behind cement and sand and gravel. The value of the asbestos fiber per ton decreased by 21% when compared with that of 1986. The asbestos operations were conducted at the Amiandos open cast mine owned by Cyprus Asbestos Mines Ltd.

Cement.—Vassilikos Cement Works Ltd. and Cyprus Cement Co. Ltd., both situated at Vassilikos, operated two plants that produced 853,699 tons of cement, slightly less than that produced in 1986. The value of cement, approximately $39.1 million, led all other mineral commodities in total value. The value per ton for cement remained the same as last year at $45.76.

Clays.—Production of bentonite was 79,600 tons, 45% more than that of 1986. The sale price per ton increased to $53.19, representing an increase of 5% over that of 1986. Cyprus' bentonite total value amounted to 5.5% of the total value of all minerals produced; however, the production of bentonite was estimated to account only for approximately 1% of the total world production. Peletico Plasters Ltd., west of Larnaca, produced the major part of bentonite. Three other smaller producers, Bentex Minerals Co. Ltd., Egek Ltd., and Drapia Mining were involved with the mining of bentonite.

Gypsum.—Production of crude gypsum was 45,700 tons, a 52% increase over that produced in 1986; however, the production of calcined gypsum decreased by 10% from that of 1986 to 4,960 tons. Prices of both crude and calcined gypsum remained the same for the third consecutive year at $4.16 per ton and $54.08 per ton, respectively. The gypsum was both used internally within Cyprus and exported to the Middle East.

Sand and Gravel.—The production of sand and gravel in Cyprus amounted to 4.2 million tons, a slight decrease from that produced in 1986; however, these two commodities were the second most valued minerals produced in Cyprus. The value per ton increased more than 14% from the 1986 price to $4.16 per ton. The total value of sand and gravel produced in Cyprus for 1987 was $17.5 million, which was 22.6% of the total value of all minerals produced in Cyprus for that year.

Strontium.—Celestite ore was mined at the Psematismenos quarry owned by Helco and production of celestite flotation concentrates, 93% strontium sulfate, amounted to 6,300 tons, 15% less than in 1986. The value of the concentrates per ton decreased by 9% compared with that of 1986. Some exploration work for the discovery and assessment of strontium minerals was carried out by the Cyprus Geological Survey Department in selected areas.

Umber.—The production of umber, iron oxide pigments, increased by 25% over that produced in 1986 to 12,500 tons. The Umber Corp. of Larnaca Ltd. was the only producing company and is situated north of Larnaca.

MINERAL FUELS

Cyprus Petroleum Refinery Ltd. produced small quantities of refined products at its only refinery at Larnaca. The throughput capacity of the plant was 16,000 barrels

per day.

The Cyprus Government was proposing legislation to control oil exploration and pumping on the island and in its territorial waters. The Soviet Union had expressed interest in exploring for oil after satellite surveys indicated the likelihood of hydrocarbon deposits offshore Limassol.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Cypriot pounds (£C) to U.S. dollars at the rate of £C1=US$2.08.

The Mineral Industry of Czechoslovakia

By John G. Panulas[1]

Although Czechoslovakia continued to be a significant producer of gallium, graphite, kaolin, magnesite, and steel in 1987, it remained dependent on imports for its supply of other mineral commodities. Having limited petroleum and gas resources, the country exploited numerous uranium deposits in North Bohemia, with a view toward developing its nuclear power capability as a major source of energy. Automation of the country's iron and steel industry was undertaken to improve product quality and increase productivity. Although preliminary statistics indicate that industrial production grew by 2.3% and national income by 2%, mining activities took place within a milieu of overproduction in energy-intensive industries and excess inventory buildup.

Government Policies and Programs.—The Government's economic restructuring program, "prestavba," called for improved efficiency, productivity, and profitability through the importation of energy-conserving machines, and the introduction of a new management approach that placed increased responsibility and decisionmaking authority with individual managers and enterprises.

A major element of Government policy was that the Czechoslovak industry no longer would manufacture everything the nation required. Rather, it would specialize in those goods it could produce at relatively low cost, export easily, and use to generate the hard currency it needed to buy capital goods for industry. As part of the new system, export of raw minerals, semimanufactures, and petrochemical products would diminish in favor of metallic products with added value, nonpetroleum chemical products, electronics, microelectronics, and robotics.

PRODUCTION

Output of gallium and graphite each amounted to about 8% of the world total. Production of magnesite accounted for approximately 6% of the whole; kaolin, roughly 3%; and, pig iron and steel, each about 2%. The Ostrava-Karviná Basin continued as the major source of bituminous coal while the North Bohemian Basin provided the bulk of brown coal. The Vitkovice steel plant in North Moravia supplied most of the steel output. The majority of kaolin was produced around Karlovy Vary, West Bohemia. In addition, six magnesite mines were operating in Slovakia.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Alumina	80,000	85,000	[e]85,000	[e]80,000	85,000
Aluminum ingot, primary only	36,156	31,635	31,000	33,078	33,000
Antimony, mine output, Sb content	900	1,000	[e]1,000	[e]1,000	1,000
Copper:					
Mine output, Cu content	9,800	10,000	[e]10,300	[e]10,000	10,000
Metal:					
Smelter, primary only	10,000	10,000	[e]10,200	[e]9,800	10,000
Refined including secondary	25,746	26,068	[e]26,500	[e]25,000	[2]27,202
Iron and steel:					
Iron ore:					
Gross weight thousand tons	1,903	1,869	1,859	1,784	[2]1,798
Fe content do	490	481	[e]490	470	470
Metal:					
Pig iron do	9,466	9,561	9,562	9,573	[2]9,788
Ferroalloys, electric-furnace do	162	151	161	160	[2]2,039
Steel, crude do	15,024	14,831	15,036	15,112	[2]15,415
Semimanufactures do	12,254	12,431	[e]12,700	[2]12,000	[2]11,364
Lead:					
Mine output, Pb content	3,162	3,078	5,244	5,700	3,200
Metal including secondary	21,030	21,134	21,437	23,602	[2]26,008
Manganese ore, gross weight[e 3]	900	900	950	900	900
Mercury 76-pound flasks	4,177	4,409	4,583	4,873	[2]4,757
Nickel metal, primary[e]	3,000	4,500	4,500	4,500	4,500
Silver thousand troy ounces	964	1,029	[e]1,000	[e]1,000	1,000
Tin:					
Mine output, Sn content	200	200	[e]200	[e]200	250
Metal including secondary	307	425	507	240	430
Tungsten, mine output, W content[e]	50	50	50	[r]50	45
Zinc:					
Mine output, Zn content	7,064	7,185	[e]7,300	[e]7,300	7,300
Metal including secondary[e]	9,100	9,100	9,250	9,250	9,300
INDUSTRIAL MINERALS					
Barite[e]	60,000	60,000	60,000	60,000	60,000
Cement, hydraulic thousand tons	10,498	10,530	10,265	10,298	[2]10,369
Clays: Kaolin do	539	540	548	546	575
Fluorspar[e] do	96	96	95	95	95
Graphite[e] do	50	50	60	60	55
Gypsum and anhydrite, crude do	848	842	772	743	[2]771
Lime, hydrated and quicklime do	3,100	3,117	3,227	3,329	[2]3,237
Magnesite, crude do	662	660	[e]670	[e]680	[2]671
Nitrogen: N content of ammonia do	591	576	526	[2]614	600
Perlite do	44	[e]44	[e]44	[e]44	[2]42
Pyrite, gross weight[e] do	140	140	145	140	140
Salt do	240	243	[e]245	[e]250	250
Sodium compounds, n.e.s.:					
Caustic soda do	332	327	331	335	332
Carbonate, manufactured do	95	101	112	113	102
Stone:					
Limestone and other calcareous stone do	23,519	23,684	23,252	23,566	[2]22,927
Quarry stone, not further described thousand cubic meters	32,844	32,274	32,269	32,826	32,000
Sulfur:					
Native[e] thousand tons	5	5	6	5	5
From pyrites[e] do	60	60	62	60	[2]38
Byproducts, all sources[e] do	10	10	12	10	10
Total[e] do	75	75	80	75	53
Sulfuric acid do	1,244	1,246	1,297	1,292	1,300
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Bituminous do	26,315	26,421	26,223	25,658	26,000
Brown and lignite do	98,878	102,857	102,315	102,738	103,000
Coke:					
Metallurgical do	8,529	8,211	8,112	8,005	8,200
Unspecified do	1,811	2,091	2,125	2,068	2,100
Fuel briquets from brown coal do	1,104	1,069	1,118	1,093	1,000
Gas:					
Manufactured, all types million cubic feet	268,532	271,710	264,859	255,854	260,000
Natural, marketed[e 4] do	26,000	24,500	24,500	24,700	25,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum:					
Crude:					
As reported ____ thousand tons__	93	95	123	142	140
Converted _ thousand 42-gallon barrels__	629	644	834	963	970
Refinery products ____ do____	[2]122,785	125,000	[r]127,500	125,000	126,000

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

[1]Table includes data available through Sept. 1988. In addition to the commodities listed, arsenic, feldspar, gold, graphite, uranium, and a variety of other petroleum products are produced, but information is inadequate to make reliable estimates of output levels.

[2]Reported figure.

[3]This material, although reported as manganese ore, is believed to be manganiferous iron ore with a manganese 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.

TRADE

Hard currency exports fell 4.4% below 1986 levels, as trade with other member states of the Council for Mutual Economic Assistance (CMEA) rose to 80% of Czechoslovakia's total world commerce. The Soviet Union continued as Czechoslovakia's largest trading partner, providing the bulk of its chromium, ferroalloys, iron ore, manganese, natural gas, nitrogen fertilizer, petroleum, pig iron, and nonferrous metals. Particularly notable was the fact that the Soviet Union was to supply Czechoslovakia with 1.33 million tons per year of iron ore pellets for 10 years as payment for its continuing work in building an iron treatment plant at Krivoj Rog, in the Ukraine, U.S.S.R. Imports would therefore increase to sustain the long-term Government plan of reduced iron and steel output. Czechoslovakia's 1986-90 5-year plan called for a 20% increase in total exports by 1990, in order to attain national income growth of 4%. In its effort to achieve this, the country increased exports of mineral commodities to its largest nonsocialist trading partners, Austria and the Federal Republic of Germany, and sought improved trade relations with Belgium, Denmark, Finland, France, Italy, the Netherlands, and Norway.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate ____	22	--		
Oxides and hydroxides ____	34	24	--	All to Netherlands.
Ash and residue containing aluminum	547	106	--	All to West Germany.
Metal including alloys:				
Scrap ____	259	330	206	West Germany 124.
Unwrought____	21,070	15,259	--	Japan 10,769; West Germany 2,203; Poland 2,063.
Semimanufactures ____	2,534	3,020	--	Poland 2,121; Hungary 433; West Germany 159.
Chromium: Oxides and hydroxides ____	31	--		
Copper:				
Ore and concentrate ____	1,184	--		
Sulfate ____	2,756	2,213	--	West Germany 1,557; France 408; Switzerland 105.
Ash and residue containing copper __	--	145	--	All to West Germany.
Metal including alloys:				
Scrap ____	989	382	--	West Germany 312; Sweden 70.
Unwrought____	57	3,699	--	All to West Germany.
Semimanufactures ____	201	66	--	Yugoslavia 40; West Germany 22; Peru 2.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Gold: Waste and sweepings value, thousands	$105	$263	--	All to West Germany.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	--	772	--	All to Hungary.
Metal:				
Scrap	140,229	101,624	--	Italy 41,222; Austria 26,495; West Germany 22,446.
Pig iron, cast iron, related materials	2,780	3,127	--	West Germany 1,624; Sweden 591; Denmark 301.
Ferroalloys:				
Ferrochromium	1,261	442	--	West Germany 425; Yugoslavia 17.
Ferromanganese	--	3,680	--	All to Hungary.
Ferrosilicomanganese	15,768	15,843	--	West Germany 10,532; Sweden 1,854; Italy 1,805.
Ferrosilicon	144	739	--	All to West Germany.
Silicon metal	37	--		
Unspecified	8,533	4,361	--	Austria 3,809; Hungary 552.
Steel, primary forms[2] thousand tons	571	533	--	Yugoslavia 274; Bulgaria 135; West Germany 20.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	1,384	1,493	15	West Germany 128; Poland 81; unspecified 990.
Universals, plates, sheets do	1,010	1,048	11	Yugoslavia 145; Poland 115; West Germany 89.
Hoop and strip do	156	151	--	West Germany 13; Italy 9; unspecified 115.
Rails and accessories do	34	45	--	NA.
Wire do	133	119	--	West Germany 22; Hungary 10; unspecified 75.
Tubes, pipes, fittings[2] do	631	626	3	U.S.S.R. 408; Poland 45; Hungary 25.
Castings and forgings, rough do	22	22	--	NA.
Lead:				
Ore and concentrate	5,943	6,141	--	All to West Germany.
Metal including alloys, scrap	23	8,625	--	Do.
Magnesium: Metal including alloys, unwrought	--	680	--	All to Jordan.
Manganese: Ore and concentrate, metallurgical-grade	--	1	--	All to West Germany.
Nickel:				
Oxides and hydroxides	78	23	--	West Germany 10; France 5; Netherlands 5.
Ash and residue containing nickel	--	66	--	All to West Germany.
Metal including alloys:				
Scrap	53	33	--	Do.
Unwrought	2	--		
Semimanufactures	--	20	--	All to Yugoslavia.
Platinum-group metals:				
Waste and sweepings value, thousands	$98	$1,420	--	West Germany $1,405; United Kingdom $15.
Metals including alloys, unwrought and partly wrought do	$971	$4,602	$3,165	Yugoslavia $999; West Germany $438.
Silver: Metal including alloys, unwrought and partly wrought do	$344	$321	--	All to West Germany.
Tin:				
Oxides	--	20	--	All to Italy.
Ash and residue containing tin	241	77	--	All to United Kingdom.
Titanium: Oxides	2,314	2,836	--	West Germany 986; Italy 963; United Kingdom 467.
Tungsten: Metal including alloys, all forms	--	3	--	All to Yugoslavia.
Uranium and/or thorium: Metal including alloys, all forms	1	--		
Zinc:				
Ore and concentrate	15,651	14,167	--	Do.
Oxides	938	886	--	Yugoslavia 710; West Germany 145; Italy 20.
Ash and residue containing zinc	4,707	3,581	--	West Germany 3,501; Belgium-Luxembourg 80.
Metal including alloys:				
Scrap	108	151	--	All to West Germany.
Unwrought	25	--		
Semimanufactures	163	--		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Other:				
Ashes and residues	3,297	103	--	West Germany 101; United Kingdom 2.
Base metals including alloys, all forms	1	6	--	Yugoslavia 3; West Germany 1; Japan 1.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	--	44	--	Belgium-Luxembourg 24; Austria 20.
Artificial:				
Corundum	4,286	4,358	--	Italy 2,555; West Germany 720; Netherlands 360.
Silicon carbide	500	886	--	West Germany 669; Belgium-Luxembourg 163; Italy 54.
Grinding and polishing wheels and stones	349	487	--	Italy 207; Belgium-Luxembourg 75; West Germany 64.
Asbestos, crude	36	--	--	
Barite and witherite	2,003	1,466	--	Austria 1,441; Belgium-Luxembourg 25.
Boron materials: Crude natural borates	20	--	--	
Cement[2] thousand tons	366	197	--	West Germany 104; Poland 24; Yugoslavia 16.
Chalk	43	21	--	All to Denmark.
Clays, crude:				
Bentonite	--	20	--	All to Italy.
Chamotte earth	26,636	77,432	--	Hungary 59,817; Italy 12,038; West Germany 4,070.
Fire clay	43,278	43,501	--	All to Yugoslavia.
Kaolin[2]	386,000	383,000	--	West Germany 141,000; Poland 70,000; Yugoslavia 37,000.
Unspecified	117,285	146,765	--	West Germany 93,681; Hungary 44,568; Sweden 3,364.
Diamond: Gem, not set or strung value, thousands	--	$4,808	$4,808	
Diatomite and other infusorial earth	4,050	4,841	--	All to Austria.
Feldspar, fluorspar, related materials	320	520	--	All to Yugoslavia.
Fertilizer materials:				
Crude, n.e.s	97	--		
Manufactured:				
Ammonia	5,245	4,684	--	West Germany 3,027; Switzerland 1,534; Poland 123.
Nitrogenous, N_2 content[3]	436,000	455,000	--	NA.
Potassic	112	--	--	
Unspecified and mixed	80	30,880	--	Austria 30,583; Yugoslavia 150; Finland 60.
Graphite, natural	1,746	2,838	--	Poland 1,427; Yugoslavia 1,391; Greece 20.
Gypsum and plaster	--	2	--	All to West Germany.
Kyanite and related materials	20	--	--	
Lime	27,774	61,445	21	Hungary 47,131; West Germany 14,293.
Magnesium compounds:				
Magnesite, crude	2,974	--		
Oxides and hydroxides[2] thousand tons	446	305	11	Hungary 78; Poland 70; West Germany 42.
Mica:				
Crude including splittings and waste	11	--		
Worked including agglomerated splittings	82	94	--	Yugoslavia 51; United Kingdom 15; Italy 11.
Pigments, mineral: Iron oxides and hydroxides, processed	1,401	1,167	--	Italy 1,067; Yugoslavia 100.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$276	$148	--	Hong Kong $134; Singapore $9; Switzerland $4.
Synthetic do.	$26	$363	--	Canada $286; Yugoslavia $35; Italy $24.
Pyrite, unroasted	20,766	13,871	--	All to Hungary.
Salt and brine	2,064	1,848	--	Hungary 1,844; West Germany 4.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	[3]12,900	[3]14,700	--	West Germany 9,603; Yugoslavia 3,371; United Kingdom 592.
Sulfate, manufactured	567	382	--	Switzerland 220; Canada 162.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	--	8,115	--	Poland 6,290; West Germany 1,169; Yugoslavia 396.
Worked	9,428	14,449	--	West Germany 14,447; Finland 2.
Gravel and crushed rock	7,654	7,932	--	West Germany 4,798; Poland 2,550; Austria 501.
Limestone other than dimension	26,792	28,953	--	All to West Germany.
Quartz and quartzite	--	3	--	Do.
Sand other than metal-bearing	263,776	282,977	--	Austria 163,423; Hungary 84,811; Yugoslavia 21,674.
Sulfur:				
Elemental, crude including native and byproduct	10,289	24	--	All to West Germany.
Sulfuric acid[3]	10,600	20,900	--	NA.
Talc, steatite, soapstone, pyrophyllite	6,549	6,790	--	Poland 6,555; Yugoslavia 212; Portugal 23.
Vermiculite, perlite, chlorite	--	989	--	All to West Germany.
Other:				
Crude	29,584	29,128	--	Hungary 18,262; Austria 5,262; West Germany 5,178.
Slag and dross, not metal-bearing	12,317	12,642	--	All to West Germany.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	110	328	--	West Germany 301; Hungary 25; Sweden 2.
Coal:				
Anthracite and bituminous[2] thousand tons	2,676	2,539	--	East Germany 762; Austria 600; Romania 431.
Briquets of anthracite and bituminous coal do	--	4	--	Mainly to Hungary.
Lignite including briquets[2] do	2,832	2,814	--	West Germany 2,480; Yugoslavia 15; Austria 11.
Coke and semicoke[2] do	1,157	1,002	--	East Germany 398; Austria 304; Hungary 170.
Gas, natural: Gaseous[3] million cubic feet	--	12,289	--	NA.
Peat including briquets and litter	222	457	--	Denmark 233; Greece 210; Italy 14.
Petroleum refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	998	1,107	(4)	West Germany 836; Austria 140; Italy 118.
Gasoline do	931	1,029	--	West Germany 706; Austria 186; Italy 82.
Mineral jelly and wax do	(4)	26	--	Austria 20; Netherlands 5.
Kerosene and jet fuel do	630	439	--	West Germany 267; Austria 130; Yugoslavia 82.
Distillate fuel oil do	1,385	[3]1,786	--	West Germany 1,261; Netherlands 238; Austria 188.
Lubricants do	776	1,299	--	Austria 1,094; Yugoslavia 77; West Germany 41.
Residual fuel oil do	4,477	4,783	--	Austria 2,701; West Germany 2,082.
Bitumen and other residues do	21	25	--	Austria 18; West Germany 7.

[p]Preliminary. NA Not available.

[1]Table prepared by Jozef Plachy. Owing to a lack of official trade data published by Czechoslovakia, this table should not be taken as a complete presentation of this country's mineral trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by trading partner countries.

[2]Official Trade Statistics of Czechoslovakia.

[3]Statistical Yearbook of Members of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

[4]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkaline-earth metals	--	1	--	All from France.
Aluminum:				
Ore and concentrate[2] thousand tons	356	399	--	Hungary 265; Yugoslavia 107.
Oxides and hydroxides	24,842	25,431	--	Hungary 15,016; Yugoslavia 10,209; West Germany 108.
Metal including alloys:				
Scrap	452	130	--	Hungary 80; West Germany 50.
Unwrought[2]	80,000	78,000	--	U.S.S.R. 66,000; Yugoslavia 9,000; Hungary 1,000.
Semimanufactures	21,155	19,014	--	Yugoslavia 15,308; Hungary 3,050; Austria 192.
Antimony: Oxides	--	20	--	France 15; West Germany 5.
Cadmium: Metal including alloys, all forms[2]	164	170	--	Bulgaria 40; Finland 40; Hungary 29.
Chromium:				
Ore and concentrate[2] thousand tons	174	188	--	U.S.S.R. 130; Cuba 20; Albania 19.
Oxides and hydroxides	761	868	--	U.S.S.R. 499; United Kingdom 365; France 4.
Cobalt: Oxides and hydroxides	2	6	--	All from United Kingdom.
Columbium and tantalum: Metal including alloys, all forms, columbium (niobium)	1	1	--	All from West Germany.
Copper: Metal including alloys:				
Scrap	265	--	--	
Unwrought[2]	67,000	65,000	--	U.S.S.R. 36,000; United Kingdom 14,000; Poland 10,000.
Semimanufactures	21,279	25,660	--	Poland 19,795; Yugoslavia 3,511; West Germany 1,192.
Gold: Metal including alloys, unwrought and partly wrought value thousands	$534	$508	--	West Germany $453; Italy $43; United Kingdom $12.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite[2] thousand tons	11,268	11,264	--	U.S.S.R. 9,310; Brazil 859; Venezuela 296.
Metal:				
Scrap do	44	43	--	Yugoslavia 39; U.S.S.R. 3; Austria 1.
Pig iron, cast iron, related materials[2] do	869	809	--	U.S.S.R. 807.
Ferroalloys:				
Ferrochromium	3,169	910	--	Italy 528; West Germany 382.
Ferromanganese	10	15	--	All from West Germany.
Ferrosilicomanganese	25	--	--	
Ferrosilicon	232	5	--	All from France.
Silicon metal	7	28	--	Italy 20; United Kingdom 8.
Unspecified	3,389	2,895	--	Sweden 1,324; West Germany 582; United Kingdom 531.
Steel, primary forms thousand tons	318	165	--	NA.
Semimanufactures:				
Bars, rods, angles, shapes sections do	193	151	(3)	Yugoslavia 6; Hungary 4; unspecified 140.
Universals, plates, sheets do	140	128	--	Bulgaria 24; Austria 6; unspecified 89.
Hoop and strip do	18	17	--	West Germany 3; Hungary 3; unspecified 11.
Rails and accessories do	5	5	--	NA.
Wire do	3	3	--	West Germany 1; Yugoslavia 1.
Tubes, pipes, fittings do	150	441	--	West Germany 109; Italy 18; unspecified 308.
Castings and forgings, rough do	9	8	--	NA.
Lead:				
Oxides	1,051	811	--	All from France.
Metal including alloys:				
Scrap	494	--	--	
Unwrought[2]	25,000	25,000	--	Yugoslavia 10,000; United Kingdom 4,000; West Germany 3,000.
Semimanufactures	40	1	--	All from United Kingdom.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Magnesium: Metal including alloys:				
Scrap	2	9	--	All from West Germany.
Unwrought	112	47	--	Italy 25; Yugoslavia 22.
Semimanufactures	49	62	--	All from West Germany.
Manganese:				
Ore and concentrate, metallurgical-grade[2] thousand tons	457	332	--	U.S.S.R. 323.
Oxides	60	257	--	Spain 240; Japan 17.
Molybdenum:				
Ore and concentrate	327	945	--	Belgium-Luxembourg 615; Netherlands 270; West Germany 60.
Oxides and hydroxides	28	--		
Metal including alloys, all forms	3	20	3	United Kingdom 14; France 3.
Nickel:				
Ore and concentrate	47	--		
Matte and speiss, Ni content	1,162	--		
Oxides and hydroxides	2,261	--		
Metal including alloys:				
Unwrought[2]	6,558	5,473	--	U.S.S.R. 3,971; United Kingdom 497; Finland 409.
Semimanufactures	36	34	--	West Germany 26; United Kingdom 4; Austria 1.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$1,634	$2,063	--	West Germany $1,870; United Kingdom $184; Switzerland $8.
Rare-earth metals including alloys, all forms	--	2	--	All from West Germany.
Selenium, elemental	1	1	--	All from United Kingdom.
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$3,914	$3,959	--	Yugoslavia $3,498; West Germany $428; Switzerland $20.
Tin:				
Oxides	1	1	--	All from United Kingdom.
Metal including alloys, unwrought[2]	3,058	3,200	--	United Kingdom 1,151; Indonesia 855; Bolivia 816.
Titanium:				
Ore and concentrate	563	150	--	West Germany 90; Netherlands 60.
Oxides	465	657	--	United Kingdom 417; West Germany 240.
Metal including alloys, all forms	7	--		
Tungsten:				
Ore and concentrate	41	62	--	All from Netherlands.
Oxides ad hydroxides	--	4	--	All from France.
Metal including alloys, all forms	1	6	--	France 3; Japan 2; Netherlands 1.
Zinc:				
Ore and concentrate	1,916	--		
Blue powder	--	4,465	--	Yugoslavia 3,864; Belgium-Luxembourg 601.
Metal including alloys:				
Unwrought[2]	58,000	61,000	--	Bulgaria 14,000; Yugoslavia 12,000; Finland 10,000.
Semimanufactures	7,145	1,673	--	Poland 1,202; Yugoslavia 452; United Kingdom 19.
Zirconium:				
Ore and concentrate	2,307	2,251	21	West Germany 1,908; Italy 322.
Metal including alloys, all forms	1	--		
Other:				
Ores and concentrates	470	75,330	--	All from Norway.
Oxides and hydroxides	12	112	--	West Germany 107; United Kingdom 5.
Base metals including alloys, all forms	47	55	(3)	Austria 33; Finland 19; France 1.
Nonferrous metals and alloys, rolled[2]	11,000	15,000	--	All from U.S.S.R.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	276	209	--	Italy 205; West Germany 3; Yugoslavia 1.
Artificial:				
Corundum	223	3,265	--	Yugoslavia 1,625; Hungary 1,592; Japan 36.
Silicon carbide	248	209	--	Italy 207; Japan 2.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Abrasives, n.e.s. —Continued				
Dust and powder of precious and semiprecious stones including diamond value, thousands	$1,109	$5	$4	West Germany $1.
Grinding and polishing wheels and stones	632	566	(3)	West Germany 282; Austria 198; France 23.
Asbestos, crude[2]	46,783	46,203	--	U.S.S.R. 32,653; Canada 4,645; Zimbabwe 3,168.
Barite and witherite	20	41	--	West Germany 40; Italy 1.
Boron materials:				
Crude natural borates	5,400	20	--	All from Finland.
Oxides and acids	440	219	--	Netherlands 128; West Germany 91.
Cement[2] thousand tons	77	76	--	East Germany 39; U.S.S.R. 33.
Chalk	1,487	1,114	--	Austria 725; France 389.
Clays, crude:				
Chamotte earth	--	1	--	All from Yugoslavia.
Kaolin	8,035	7,698	--	Hungary 6,172; United Kingdom 1,491; West Germany 35.
Unspecified	885	301	--	West Germany 140; France 122; Austria 39.
Diamond:				
Gem, not set or strung value, thousands	$39	$282	--	Belgium-Luxembourg $233; Switzerland $34; Netherlands $15.
Industrial stones do	$1,512	$1,005	$26	Switzerland $554; Belgium-Luxembourg $424.
Diatomite and other infusorial earth	2,878	1,881	--	Iceland 1,299; France 332; Austria 197.
Feldspar, fluorspar, related materials:				
Feldspar	--	97	--	All from Yugoslavia.
Fluorspar	144	144	--	All from West Germany.
Unspecified	1,080	900	--	All from Finland.
Fertilizer materials: Manufactured:				
Ammonia	50	3,407	--	Hungary 3,382; Belgium-Luxembourg 25.
Nitrogenous, N_2 content[2] thousand tons	174	185	--	U.S.S.R. 168.
Phosphatic, P_2O_5 content do	[4]124	[4]142	24	Tunisia 10; Yugoslavia 7; unspecified 93.
Potassic, K_2O content[2] do	556	572	--	East Germany 396; U.S.S.R. 160.
Unspecified and mixed do	4	64	--	Austria 63; Yugoslavia 1.
Graphite, natural	307	357	--	Japan 248; West Germany 109.
Gypsum and plaster[2] thousand tons	26	23	--	East Germany 22.
Iodine	--	1	--	All from Italy.
Lime	21	33	--	West Germany 29; Austria 4.
Magnesium compounds:				
Magnesite, crude	--	64	--	All from Netherlands.
Oxides and hydroxides	1,617	857	38	France 383; Austria 296; West Germany 140.
Other	--	1,116	--	All from West Germany.
Mica:				
Crude including splittings and waste	24	55	--	Austria 29; France 26.
Worked including agglomerated splittings	18	3	--	Austria 2; Switzerland 1.
Nitrates, crude	--	1,673	--	All from Bulgaria.
Phosphates, crude, P_2O_5 content[2] thousand tons	282	273	--	U.S.S.R. 125; Morocco 41; Jordan 36.
Pigments, mineral:				
Natural, crude	20	56	--	France 32; West Germany 24.
Iron oxides and hydroxides, processed	1,175	367	--	Belgium-Luxembourg 357; Italy 10.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$22	$27	--	Thailand $13; West Germany $10; Switzerland $4.
Synthetic do	$33	$72	--	Switzerland $61; Austria $5; Belgium-Luxembourg $5.
Pyrite, unroasted	32	20	--	All from Italy.
Salt and brine	139,964	150,342	--	U.S.S.R. 150,320; Belgium-Luxembourg 17; Sweden 3.
Sodium compounds, n.e.s.:				
Carbonate, manufactured[2] thousand tons	203	186	--	East Germany 82; Bulgaria 36; Romania 22.
Sulfate, manufactured	1	--		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	NA	13,667	--	Yugoslavia 12,117; Hungary 1,458; Italy 56.
Worked	1,829	146	--	Italy 66; Yugoslavia 56; Spain 13.
Dolomite, chiefly refractory-grade	91	111	--	All from West Germany.
Gravel and crushed rock	5,944	7,809	--	Yugoslavia 4,079; Italy 2,660; France 1,070.
Quartz and quartzite	970	1,168	--	All from West Germany.
Sand other than metal-bearing	4,701	4,565	--	Hungary 3,935; West Germany 303; Belgium-Luxembourg 292.
Sulfur:				
Elemental:				
Crude including native and by-product[2] thousand tons	505	466	--	All from Poland.
Colloidal, precipitated, sublimed	70	21	--	All from France.
Dioxide	261	262	--	All from West Germany.
Sulfuric acid[2]	73,980	71,274	--	U.S.S.R. 66,166; East Germany 5,011.
Talc, steatite, soapstone, pyrophyllite	1,516	1,520	--	Austria 913; Belgium-Luxembourg 421; West Germany 145.
Other:				
Crude	10,242	7,991	--	Hungary 4,896; West Germany 2,521; Finland 469.
Slag and dross, not metal-bearing	111	94	--	All from Netherlands.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	60	59	--	All from West Germany.
Carbon black[2]	16,422	14,666	--	U.S.S.R. 9,080; Romania 2,670; East Germany 1,129.
Coal:[2]				
Anthracite and bituminous thousand tons	4,686	4,896	--	U.S.S.R. 3,125; Poland 1,671.
Lignite including briquets do	736	658	--	All from East Germany.
Gas, natural: Gaseous[4] million cubic feet	381,785	408,907	--	All from U.S.S.R.
Peat including briquets and litter	--	68	--	All from United Kingdom.
Petroleum:				
Crude[4] thousand 42-gallon barrels	124,215	130,830	--	Mainly from U.S.S.R.
Refinery products:				
Liquefied petroleum gas do	(3)	(3)	--	All from West Germany.
Gasoline[4] do	3,859	3,145	--	NA.
Mineral jelly and wax do	7	6	--	West Germany 5.
Kerosene and jet fuel do	46	42	--	West Germany 26; Yugoslavia 8; Italy 5.
Distillate fuel oil[4] do	50	213	--	NA.
Lubricants do	237	163	(3)	Austria 116; Yugoslavia 26; West Germany 10.
Residual fuel oil do	92	13	--	All from United Kingdom.
Bitumen and other residues do	17	--	--	
Bituminous mixtures do	(3)	(3)	--	Mainly from Austria.
Petroleum coke do	44	41	--	All from West Germany.

[p]Preliminary. NA Not available.

[1]Table prepared by Jozef Plachy. Owing to a lack of official trade data published by Czechoslovakia, this table should not be taken as a complete presentation of this country's mineral trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries.

[2]Official Trade Statistics of Czechoslovakia.

[3]Less than 1/2 unit.

[4]Statistical Yearbook of Members of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

COMMODITY REVIEW

METALS

Gallium.—About 3,500 kilograms of 99.9% and 99.99%-pure gallium metal was produced at the Ziar and Hronom alumina refinery in 1987. Output was expected to rise to at least 4,000 kilograms by the end of the decade, as the country was engaged in the manufacture of high-speed gallium arsenide integrated circuits. In addition, it was expected that the gallium would be used in superconductors. Particularly noteworthy were the experimental use of gallium as a telescopic metal target in detecting and quantifying solar neutrinos and its application in photoelectric solar cells.

Gold.—A study, sponsored in part by the Ore Research Institute of Prague, continued with a view toward determining whether a 300,000-ton-per-year open pit and beneficiation facility would be constructed. In addition, the Western Australian Development Corp. and Czechoslovak Government were considering a joint venture to treat old dumps from former gold mine operations.

Gold prospecting continued with vigor during 1987. Mining was expected to resume in the central region of the Vultana River Basin and in South Bohemia by the end of the decade. The open pit mine at Celina Morkrsko was scheduled to restart by 1990. Reserves there were thought to amount to 100 tons of gold. Plans also called for the development of reserves in the western Carpathians, as well as exploration of gold-scheelite deposits in Karpenske Hory in Bohemia and Soviansko in Slovakia.

Iron and Steel.—Emphasis was switched from the production of crude steel to the production of semimanufactures and finished products. Accordingly, modernization plans were focused on the construction of new facilities for the continuous casting of steel. Production of steel castings and forgings was scheduled to rise to 50% of total steel output by 1995. Particularly significant in this regard were improvements made to the Smervna steelworks at Podbrozova where an Asea/SKF (Sweden) electromagnetic stirrer was attached to a continuous casting machine to improve the quality of the continuously cast billets used for tube production.

Much of the steelmaking process at the iron and steel works in Czechoslovakia was becoming controlled by computers and microprocessors. Noteworthy was construction of the final processing shops and automated storage of finished products at the Poldi steel plant at Kladno, where a modern 450,000-ton-per-year medium and light section rolling mill supplied by Sket (German Democratic Republic) was installed, and a 100-ton-per-year electric arc furnace was modified to include water-cooled panels. The rolling mill was to produce medium and light bars of high-quality carbon steel and ferritic stainless steel. In an effort to conserve energy and other resources, two old rolling mills at the Kralodvorske works in Beroun and the sheet mill in Frydek-Mistek were eliminated. The East Slovakia iron and steel combine, working with Clecim, the French concern, modernized its cold-sheet mill and overhauled its hot wide strip operation at Kosice in eastern Czechoslovakia. The modernization was expected to achieve higher dimensional accuracy for its strip products.

Other developments of importance were the startup of an Asea/SKF (Sweden) secondary steelmaking plant at the Skoda steelworks in Plzen. Reportedly, steel production at that facility increased 20% as a result of the new plant. Another secondary steelmaking plant, furnished with powder injection equipment, was provided by Scandinavian Lancers and brought on-line at the Vitkovice steelworks at Ostrava.

Tin.—Tin mining was renewed at the Stannum Mine, 100 kilometers west of Prague. The ore body consists of tin and tungsten, with smaller amounts of mica, minor sulfides, and topaz also occurring. Output was expected to reach 250,000 tons of ore processed per year. The Czechoslovak Government invested 500 korunas (Kcs)[2] in the project.

Other Metals.—Work continued on construction of a metallurgical complex in Bruntal, North Moravia, which was expected to process 60,000 tons of base metal concentrates from copper, lead, and zinc ores, as well as rare elements. The Tiscova copper mine in Bohemia was overhauled for more productive operation, while copper ore bodies at Banska Stiavnica, Slovinky, and Maria near Roznava continued to be exploited. In Central Bohemia, further identifications of lead and zinc ores were made, as were discoveries of new zinc deposits in the Zelezne Hory Mountains. In addition, a new lead and zinc mine in Zlate Hory-East was opened.

INDUSTRIAL MINERALS

The prominent producers of kaolin were Chlumcanske Keramicke Zavody, Keramicke a Sklarske Suroviny, Moravske Keramicke Zavody, and Zapodceske Keramicke Zavody. Much of the kaolin for the ceramic industry was mined in the Karlovy Vary region of Czechoslovakia, and kaolin supplied to the paper industry was mined in the Plzen Basin. Ore was mined by open pit methods and beneficiated via sizing and high-intensity magnetic removal of impurities. Annual output was about 575,000 tons, with kaolin reserves estimated at 60 million tons.

MINERAL FUELS

Coal.—Coal accounted for 70% of the national fuel requirement. Coal exploration continued in several parts of the country. Approximately 1.5 million tons of coking coal was identified in the Ostrava-Karviná Basin. Although bituminous coal reserves of 4.5 million tons were also identified at Ostrava, their location, 600 to 1,000 meters below the surface, posed technical impediments to output. Lignite reserves there were measured at 5.5 million tons and were expected to be depleted within 30 years.

Natural Gas.—Work neared completion on a Czechoslovak-built natural gas pipeline that would carry Soviet natural gas through Czechoslovakia to customers in Austria, the Federal Republic of Germany, Italy, and Yugoslavia. Deliveries taken by Czechoslovakia itself were to serve as compensation for the construction work. Utilizing pipes, 55 inches in diameter, the 2,607-mile line was expected to increase Czechoslovakia's annual consumption of Soviet natural gas by 450 billion cubic feet by 1989. During 1987, the country imported 380 billion cubic feet of natural gas from the Soviet Union, and produced about 25 billion cubic feet, roughly 7% of its known reserves. In tandem with plans to replace oil and manufactured coal gas with natural gas for residential and industrial uses, exploration of South Moravia, and southern and eastern Slovakia continued. Results suggested that future output of as much as 70 billion cubic feet per year was possible.

Nuclear Power.—In 1987, a sixth and seventh nuclear reactor commenced operations at the Dukovany and Jaslorce Bohunice plants. The facilities together produced about 25% of Czechoslovakia's electricity. Work on a 440-megawatt plant at Mochovitse continued, as did construction of a 1,000-megawatt reactor at Temelin. The Mochovitse reactor was expected to start in 1992.

In light of the Chernobyl accident, the Czechoslovak atomic power program began investing in making the country's nuclear powerplants more resistant to natural disasters, such as earthquakes. Estimates valued the investment as equal to a 1-year capital outlay for the entire fuel and power sector of the Czechoslovak economy.

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[1]Physical scientist, Division of International Minerals.

[2]The Czechoslovak koruna (Kcs) is not convertible to U.S. dollars, and as such, values are expressed in korunas. The official exchange rate does not reflect comparative values of the two currencies.

The Mineral Industry of Denmark and Greenland

By Richard H. Singleton[1]

DENMARK

The total value of Denmark's mineral industry approximated $1.3 billion,[2] about 75% of which was raw petroleum products from the Danish North Sea. The only significant metals industry was the steel plant, which was based on scrap. Significant industrial minerals were cement, diatomaceous materials, and crushed and dimension stone.

Denmark's production of North Sea oil and gas continued to increase significantly and provided more than 25% of the country's energy requirements in 1987. The major objective of the Government's energy policy continued to be the reduction of net oil imports. About one-half of the country's oil was supplied from indigenous sources. The initial gas distribution network on the mainland was completed for domestic distribution as well as for pipeline export to the Federal Republic of Germany and Sweden. Development of North Sea petroleum resources continued, but at a slower rate because of near saturation of the gas market, low oil prices, and estimated oil reserve limitations.

Austere measures taken by the Danish Government in 1986 to limit domestic consumption succeeded in nearly halving the 1986 deficit to below $3 billion in 1987. However, the relatively high growth rate in the real gross domestic product maintained during the previous 3 years was reduced to near zero. Employment and interest rates did not change significantly. A left-of-center Government was elected in September without a majority. Pressure for increased spending was expected to ensue.

PRODUCTION AND TRADE

Production of North Sea oil and gas each again increased to record highs. Importation of mineral fuels continued to fall. Cement and lime sales decreased in response to reduced construction activity. Imports of U.S. coal and coke decreased by 40% to 1.4 million tons. Danish exports to the United States remained at $1.9 billion. Imports from the United States increased by 15% to $861 million. The persistent U.S. trade deficit with Denmark remained near $1 billion.

Table 1.—Denmark: Sales of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
Cement, hydraulic thousand tons	1,657	1,668	1,739	2,029	[2]1,887
Clays:[e]					
Kaolin	10,000	14,000	13,000	[2]10,404	11,000
Other, for ceramic uses	4,500	[2]4,168	[2]4,686	6,000	6,000
Cryolite[3]	17,200	20,300	17,900	18,000	[2]17,200
Diatomaceous materials:					
Diatomite[e]	6,000	10,000	6,000	6,000	6,000
Moler	[e]65,000	63,745	72,029	72,958	66,000
Gas, natural[3] million cubic feet	--	8,228	38,811	67,274	[2]85,700
Iron and steel:[3]					
Steel, crude thousand tons	493	548	528	632	[2]606
Semimanufactures do.	410	462	511	539	[2]538
Lead, metal including alloys, secondary[4]	10,052	13,019	4,503	[e]560	--
Lime, hydrated and quicklime thousand tons	108	128	129	134	[2]119
Nitrogen: N content of ammonia	11,700	--	--	--	--
Peat thousand tons	[e]34	32	39	48	50
Petroleum:[3]					
Crude thousand 42-gallon barrels	16,460	17,700	22,120	27,700	[2]35,200
Refinery products:					
Gasoline do.	10,548	10,438	10,226	11,110	11,100
Jet fuel do.	271	681	1,017	1,525	1,100
Kerosene do.	78	429	125	172	200
Distillate fuel oil do.	22,178	23,162	22,326	24,723	23,700
Residual fuel oil do.	12,762	13,498	12,256	13,792	15,500
Liquefied petroleum gas do.	1,495	1,656	1,506	1,863	2,000
Naphtha do.	1,074	1,320	1,401	1,647	1,800
Bitumen do.	446	533	521	347	400
Refinery fuel and losses do.	2,850	3,020	2,880	3,322	2,300
Total do.	51,702	54,737	52,258	58,501	59,100
Salt[3] thousand tons	407	523	532	564	[2]531
Sand, industrial thousand cubic meters	900	1,026	1,368	1,629	1,600
Sand and gravel[3]	[e]22,000	23,200	24,600	28,500	[2]32,100
Sodium carbonate thousand tons	144	126	114	117	120
Stone:					
Crushed:					
Flint thousand cubic meters	[e]60	47	54	59	60
Limestone:					
Agricultural thousand tons	[e]2,200	2,163	[r]1,882	1,972	2,000
Industrial do.	[e]140	145	142	153	150
Chalk do.	[e]180	220	203	249	250
Other thousand cubic meters	[e]1,000	1,183	1,275	1,365	1,400
Dimension (mostly granite) do.	[e]100	154	156	213	200
Sulfur, byproduct	[e]9,000	10,859	7,376	12,810	13,000

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 30, 1988.
[2]Reported figure.
[3]Data represent production.
[4]Includes antimonial lead.

Table 2.—Denmark: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals: Alkali metals	1	7	--	West Germany 4; Spain 3.
Aluminum:				
Ore and concentrate	2,042	--		
Oxides and hydroxides	166	176	63	United Kingdom 60; France 10.
Ash and residue containing aluminum	58	198	--	United Arab Emirates 102; Sweden 61; Finland 35.
Metal including alloys:				
Scrap	16,669	20,552	--	West Germany 12,712; Netherlands 3,020; Norway 2,071.
Unwrought	12,129	10,222	--	West Germany 6,715; Belgium-Luxembourg 1,854; Portugal 354.
Semimanufactures	27,672	28,995	231	West Germany 8,567; Sweden 6,771 United Kingdom 5,201.

See footnote at end of table.

Table 2.—Denmark: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Antimony: Metals including alloys, all forms	3	(2)	--	All to Saudi Arabia.
Arsenic: Oxides and acids	--	10	--	All to Sweden.
Bismuth: Metals including alloys, all forms	1	(2)	--	Mainly to Algeria.
Cadmium: Metal including alloys, all forms	1	--		
Chromium:				
Oxides and hydroxides	4	3	--	All to Sweden.
Metal including alloys, all forms	1	(2)	--	All to Spain.
Cobalt: Oxides and hydroxides	4	--		
Columbium and tantalum: Metal including alloys, all forms, tantalum	(2)	--		
Copper:				
Oxides and hydroxides	37	(2)	--	NA.
Sulfate	3	27	--	Greenland 25; Finland 1.
Ash and residue containing copper	915	1,282	--	Sweden 697; West Germany 580; Netherlands 5.
Metal including alloys:				
Scrap	15,767	14,130	--	West Germany 12,319; Belgium-Luxembourg 725; East Germany 353.
Unwrought	1,558	2,065	--	Sweden 840; West Germany 540; Portugal 491.
Semimanufactures	3,999	6,024	(2)	West Germany 2,469; Sweden 875; Belgium-Luxembourg 796.
Gold:				
Waste and sweepings value, thousands	$5,298	$5,401	--	Netherlands $2,761; Switzerland $1,548; West Germany $590.
Metal including alloys, unwrought and partly wrought do.	$1,642	$3,338	--	Netherlands $1,454; Finland $750; West Germany $547.
Hafnium: Metal including alloys, all forms	--	20	--	All to Netherlands.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	6,834	4,870	94	United Kingdom 1,727; West Germany 1,366; Netherlands 1,260.
Pyrite, roasted	--	598	--	Netherlands 550; West Germany 48.
Metal:				
Scrap	269,535	182,617	--	West Germany 138,286; Netherlands 16,868; Sweden 14,638.
Pig iron, cast iron, related materials	392	343	--	West Germany 255; Tanzania 35; United Kingdom 17.
Ferroalloys:				
Ferrochromium	--	(2)	--	All to Finland.
Ferrosilicomanganese	(2)	1	--	All to Sweden.
Silicon metal	83	34	1	Sweden 32; Saudi Arabia 1.
Unspecified	21	1	--	All to Belgium-Luxembourg.
Steel, primary forms	8,833	5,952	1	Sweden 3,191; West Gemrmany 2,636; United Kingdom 35.
Semimanufactures:				
Bars, rods, angles, shapes, sections	105,817	113,401	40	West Germany 41,151; Sweden 23,119; United Kingdom 15,299.
Universals, plates, sheets	309,283	340,736	5,903	West Germany 107,320; Sweden 64,944; United Kingdom 45,729.
Hoop and strip	22,074	27,470	(2)	Sweden 14,693; United Kingdom 7,881; France 1,948.
Rails and accessories	2,731	354	--	West Germany 321; Norway 19; Greenland 6.
Wire	4,939	4,699	17	Sweden 1,372; West Germany 850; Finland 710.
Tubes, pipes, fittings	85,543	77,525	541	Sweden 36,755; West Germany 13,021; United Kingdom 11,001.
Castings and forgings, rough	35,686	35,379	2	West Germany 16,273; Sweden 11,468; Norway 2,325.
Lead:				
Oxides	16	7	--	West Germany 4; Kenya 2.
Ash and residue containing lead	2,204	109	--	United Kingdom 45; Belgium-Luxembourg 44; West Germany 20.
Metal including alloys:				
Scrap	14,530	14,344	--	West Germany 8,270; Sweden 4,897; United Kingdom 615.
Unwrought	3,985	3,244	--	Belgium-Luxembourg 1,851; Netherlands 598; West Germany 294.
Semimanufactures	50	326	--	United Kingdom 244; Sweden 26; Japan 20.

See footnotes at end of table.

Table 2.—Denmark: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Lithium:				
Oxides and hydroxides	--	48	--	All to West Germany.
Metal including alloys, all forms	(2)	--		
Magnesium: Metal including alloys:				
Scrap	130	101	--	Do.
Unwrought	(2)	15	--	Do.
Semimanufactures	4	20	--	Sweden 13; United Kingdom 6; Norway 1.
Manganese:				
Oxides	13	3	--	All to Sweden.
Metal including alloys, all forms	(2)	(2)	--	All to West Germany.
Mercury 76-pound flasks	174	29	--	Mainly to West Germany.
Nickel:				
Matte and speiss	--	2	--	All to United Kingdom.
Ash and residue containing nickel	438	551	--	United Kingdom 227; West Germany 213; Belgium-Luxembourg 61.
Metal including alloys:				
Scrap	14	19	--	Sweden 10; West Germany 9.
Unwrought	(2)	4	--	Finland 2; Iceland 2.
Semimanufactures	2	24	--	Finland 7; Norway 5; West Germany 4.
Platinum-group metals:				
Waste and sweepings value, thousands	$1,920	$2,851	--	West Germany $2,615; Netherlands $189; United Kingdom $24.
Metals including alloys, unwrought and partly wrought do.	$788	$1,577	--	Sweden $1,062; Netherlands $158; France $155.
Selenium, elemental	(2)	3	--	All to Finland.
Silver:				
Waste and sweepings value, thousands	$6,801	$7,259	--	United Kingdom $3,940; Switzerland $1,136; France $982.
Metal including alloys, unwrought and partly wrought do.	$2,969	$2,214	--	Sweden $871; Finland $729; Norway $221.
Tellurium, elemental and arsenic	2	--		
Tin:				
Ash and residue containing tin	486	102	--	United Kingdom 54; Belgium-Luxembourg 23; West Germany 19.
Metal including alloys:				
Scrap	180	261	--	Sweden 109; Belgium-Luxembourg 103; West Germany 27.
Unwrought	1,341	1,431	--	Belgium-Luxembourg 1,248; West Germany 73; Sweden 40.
Semimanufactures	15	20	--	West Germany 6; Finland 4; Sweden 3.
Titanium:				
Oxides	86	207	--	West Germany 54; Canada 50; Ecuador 21.
Metal including alloys:				
Scrap	9	8	--	All to United Kingdom.
Semimanufactures	r2	3	--	Sweden 2; West Germany 1.
Tungsten: Metal including alloys:				
Scrap	28	40	--	West Germany 39; Sweden 1.
Unwrought	2	--		
Semimanufactures	(2)	--		
Vanadium: Oxides and hydroxides	--	1	--	All to Belgium-Luxembourg.
Zinc:				
Oxides	13	31	--	West Germany 15; Malta 11; Saudi Arabia 3.
Blue powder	198	205	12	West Germany 112; Norway 19.
Matte	1,309	1,256	--	Norway 1,085; West Germany 171.
Ash and residue containing zinc	1,304	1,683	--	Norway 1,159; West Germany 299; India 157.
Metal including alloys:				
Scrap	4,078	3,767	--	Norway 1,709; West Germany 1,048; Sweden 112.
Unwrought	42	80	--	West Germany 45; Sweden 26; Uruguay 7.
Semimanufactures	r72	28	--	Greenland 20; Norway 3; West Germany 2.
Zirconium: Metal including alloys, all forms	(2)	--		

See footnotes at end of table.

Table 2.—Denmark: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Other:				
Ores and concentrates	483	469	--	West Germany 318; Sweden 145; Norway 6.
Oxides and hydroxides	1	20	--	All to Finland.
Ashes and residues	263	3,876	--	United Kingdom 3,621; West Germany 156; Netherlands 74.
Base metals including alloys, all forms	3	--		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	21	4	--	Iceland 2.
Artificial: Silicon carbide	3	(2)	--	Mainly to Algeria.
Dust and powder of precious and semi-precious stones including diamond value, thousands	$1	--		
Grinding and polishing wheels and stones	794	1,553	3	Ethiopia 690; Egypt 313; Djibouti 116.
Asbestos, crude	50	--		
Barite and witherite	12	45	--	Sweden 31; Ecuador 8; Bahrain 2.
Boron materials:				
Crude natural borates	10	6	--	Norway 5.
Elemental	--	9	--	All to Israel.
Oxides and acids	19	34	--	Sweden 18; Finland 13; Norway 3.
Cement	308,441	327,228	3	Greenland 10,667; Finland 4,870; unspecified 304,441.
Chalk	75,724	113,179	--	Finland 94,173; United Kingdom 7,241; Sweden 6,292.
Clays, crude:				
Bentonite	16	16	--	Sweden 7; Netherlands 5; Oman 2.
Chamotte earth	1,222	13	--	Belgium-Luxembourg 8; Finland 3; West Germany 2.
Fuller's earth	--	3	--	Singapore 1; Sweden 1.
Kaolin	599	685	--	Sweden 309; West Germany 193; Norway 87.
Unspecified	1,612	3,170	1	West Germany 1,192; Sweden 664; Netherlands 611.
Cryolite and chiolite	20,940	20,770	NA	NA.
Diamond:				
Gem, not set or strung value, thousands	$196	$249	$1	Israel $110; Belgium-Luxembourg $32; West Germany $30.
Industrial stones ---do---	--	$1	--	All to Spain.
Diatomite and other infusorial earth	71,948	74,105	--	West Germany 23,154; United Kingdom 18,274; Netherlands 13,438.
Feldspar, fluorspar, related materials:				
Feldspar	37	5	--	All to France.
Fluorspar	24	--		
Fertilizer materials:				
Crude, n.e.s	2	1	--	NA.
Manufactured:				
Ammonia	570	486	--	Sweden 461; Iceland 5; Libya 4.
Nitrogenous	3,330	756	--	West Germany 624; Sweden 96; Greenland 20.
Phosphatic	71,441	46,057	--	Sweden 320; Norway 107; unspecified 45,510.
Potassic	39	48	--	Sweden 36; France 6; West Germany 6.
Unspecified and mixed	535,039	395,839	--	West Germany 5,092; Sweden 557; unspecified 390,045.
Graphite, natural	(2)	146	--	West Germany 145.
Gypsum and plaster	2,013	3,132	1	Sweden 2,858; West Germany 180; Norway 68.
Iodine	34	134	--	Sweden 126; Taiwan 7; Malawi 1.
Kyanite and related materials	13	72	--	All to Netherlands.
Lime	10,367	14,357	90	Norway 8,551; Finland 3,705; Sweden 942.
Magnesium compounds: Oxides and hydroxides	12	8	--	Saudi Arabia 3; Sweden 3; Norway 1.
Mica: Crude including splittings and waste	1	3	--	Mainly to Sweden.
Nitrates, crude	r1,713	1,369	215	United Kingdom 1,030; Japan 53.
Pigments, mineral:				
Natural, crude	33	48	--	Turkey 27; Sweden 10; Indonesia 6.
Iron oxides and hydroxides, processed	212	185	--	Sweden 49; Iceland 30; Ecuador 15.

See footnotes at end of table.

Table 2.—Denmark: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Precious and semiprecious stones other than diamond:				
Natural ____ value, thousands__	$85	$77	__	Hong Kong $17; Norway $16; West Germany $15.
Synthetic ____ do____	$10	$6	__	Iceland $3; Sweden $2.
Pyrite, unroasted____	20	3	__	NA.
Salt and brine____	236,945	272,075	2	Sweden 144,463; Norway 100,992; Finland 15,805.
Sodium compounds, n.e.s.: Carbonate, manufactured ____	54	63	__	West Germany 24; Iceland 23; Greenland 15.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked ____	87,616	51,996	__	West Germany 51,668; Italy 49; Norway 48.
Worked____	11,361	11,275	11	West Germany 8,780; Norway 1,288; Sweden 834.
Dolomite, chiefly refractory-grade __	139	114	__	Iceland 100; United Kingdom 5; Norway 3.
Gravel and crushed rock ____	679,089	674,922	__	West Germany 657,637; Sweden 8,367; Netherlands 4,501.
Limestone other than dimension ___	126,741	116,081	__	West Germany 55,174; Norway 30,830; Sweden 26,742.
Quartz and quartzite____	340	221	__	France 69; Sweden 42; Saudi Arabia 36.
Sand other than metal-bearing ____	212,798	212,648	111	Sweden 155,346; West Germany 23,034; Norway 19,353.
Sulfur:				
Elemental:				
Crude including native and byproduct ____	3,242	3,222	__	West Germany 3,220; Norway 1.
Colloidal, precipitated, sublimed_	499	4,642	__	Belgium-Luxembourg 3,810; France 829; Ghana 3.
Dioxide____	2	2	__	All to Angola.
Sulfuric acid____	14,163	465	__	Norway 226; Angola 68; Sweden 61.
Talc, steatite, soapstone, pyrophyllite __	81	65	__	Ecuador 25; Ireland 6; Thailand 5.
Vermiculite, perlite, chlorite____	40	76	__	Norway 60; Sweden 16.
Other:				
Crude____	694	533	18	West Germany 345; Greenland 80; Norway 32.
Slag and dross, not metal-bearing ___	139,097	129,023	__	Norway 97,449; West Germany 26,928; France 3,750.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural ____	548	207	__	Sweden 71; Finland 12; Malaysia 11.
Carbon:				
Carbon black ____	15	16	__	Sweden 6; Thailand 3; Cyprus 2.
Gas carbon ____	21	26	__	Norway 19; West Germany 6; United Arab Emirates 1.
Coal:				
Anthracite____	16	2	__	All to Sweden.
Bituminous ____	71,183	63,560	__	Sweden 47,238; Netherlands 10,216; Finland 4,073.
Briquets of anthracite and bituminous coal____	5	2	__	All to Iceland.
Lignite including briquets ____	__	39	__	Sweden 27; Norway 11.
Coke and semicoke____	1,499	2,564	__	Sweden 1,881; United Kingdom 612; Iceland 49.
Gas, natural: Gaseous million cubic feet__	18,018	24,948	__	West Germany 15,572; Sweden 9,376.
Peat including briquets and litter ____	6,741	5,944	__	Netherlands 5,137; United Kingdom 418; Sweden 165.
Petroleum:				
Crude_ thousand 42-gallon barrels__	7,977	6,434	__	Sweden 5,080; United Kingdom 1,022; Norway 332.

See footnotes at end of table.

Table 2.—Denmark: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	342	519	--	Netherlands 197; Sweden 114; West Germany 23.
Gasoline ---do---	5,452	5,922	32	Sweden 3,636; Netherlands 733; United Kingdom 620.
Mineral jelly and wax ---do---	6	6	--	Sweden 4.
Kerosene and jet fuel ---do---	868	651	--	West Germany 590; Greenland 25; Sweden 23.
Distillate fuel oil ---do---	5,249	5,344	--	Sweden 4,033; West Germany 545; Greenland 468.
Lubricants ---do---	141	63	(2)	Norway 21; Greenland 11; West Germany 6.
Residual fuel oil ---do---	4,683	6,461	121	United Kingdom 3,724; West Germany 1,163; Ireland 296.
Bitumen and other residues ---do---	118	33	--	Finland 23; Greenland 6; Norway 2.
Bituminous mixtures ---do---	11	9	--	West Germany 4; Sweden 2; Norway 1.
Petroleum coke ---do---	66	290	--	Ireland 188; Sweden 93; United Kingdom 9.

rRevised. NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals: Alkali metals	249	278	--	West Germany 219; France 56; Sweden 3.
Aluminum:				
Ore and concentrate	723	554	--	China 552; West Germany 2.
Oxides and hydroxides	4,403	4,584	692	United Kingdom 2,395; West Germany 1,394.
Ash and residue containing aluminum	1,497	2,011	--	West Germany 1,858; Sweden 152.
Metal including alloys:				
Scrap	8,881	5,315	19	West Germany 2,018; United Kingdom 1,175; Sweden 932.
Unwrought	28,391	34,280	8	Norway 16,755; Netherlands 6,610; West Germany 5,773.
Semimanufactures	66,587	72,909	155	West Germany 20,123; Sweden 11,201; Norway 10,399.
Antimony:				
Oxides	32	68	--	United Kingdom 59; Belgium-Luxembourg 9.
Metal including alloys, all forms	(2)	(2)	NA	NA.
Arsenic: Oxides and acids	80	10	--	All from Belgium-Luxembourg.
Beryllium:				
Oxides and hydroxides	73	35	--	All from West Germany.
Metal including alloys, all forms	(2)	(2)		All from United Kingdom.
Bismuth: Metal including alloys, all forms	2	1	--	Mainly from West Germany.
Cadmium: Metal including alloys, all forms	3	1	--	Mainly from United Kingdom.
Chromium:				
Ore and concentrate	1,323	1,473	--	West Germany 1,401; United Kingdom 48; Netherlands 24.
Oxides and hydroxides	183	392	(2)	West Germany 284; Italy 106.
Metal including alloys, all forms	1	1	--	Mainly from Italy.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Cobalt:				
Oxides and hydroxides	6	9	--	United Kingdom 6; Belgium-Luxembourg 1; Canada 1.
Metal including alloys, all forms	25	23	(2)	Belgium-Luxembourg 17; Finland 5.
Columbium and tantalum: Metal including alloys, all forms:				
Columbium (niobium)	(2)	(2)	--	All from Austria.
Tantalum	(2)	(2)	(2)	
Copper:				
Ore and concentrate	23	--		
Oxides and hydroxides	773	725	--	West Germany 348; Italy 182; Norway 147.
Sulfate	2,486	2,050	--	Italy 1,088; Belgium-Luxembourg 639; France 156.
Ash and residue containing copper	1,005	1,768	--	All from West Germany.
Metal including alloys:				
Scrap	4,482	7,164	--	Sweden 4,009; West Germany 1,603; Ireland 527.
Unwrought	2,002	2,011	--	United Kingdom 1,113; Sweden 728; West Germany 115.
Semimanufactures	37,164	39,373	33	West Germany 21,654; Sweden 6,726; Finland 2,438.
Germanium: Metal including alloys, all forms	(2)	--		
Gold:				
Waste and sweepings value, thousands	$164	$221	--	Norway $151; Sweden $58; West Germany $7.
Metal including alloys, unwrought and partly wrought ---do---	$7,304	$11,729	$1	Switzerland $4,629; Netherlands $3,282; United Kingdom $1,509.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	1,933	3,390	--	Sweden 3,329; West Germany 54; France 7.
Pyrite, roasted	19,710	28,981	--	All from Norway.
Metal:				
Scrap	47,649	121,061	--	United Kingdom 43,108; U.S.S.R. 35,057; West Germany 33,281.
Pig iron, cast iron, related materials	62,676	80,212	21	U.S.S.R. 24,581; Brazil 20,993; Sweden 8,213.
Ferroalloys:				
Ferrochromium	115	63	--	Sweden 38; West Germany 21; United Kingdom 4.
Ferromanganese	2,023	1,618	(2)	Norway 878; West Germany 727; France 13.
Ferromolybdenum	17	5	--	All from Sweden.
Ferrosilicochromium	28	23	--	Sweden 20; United Kingdom 3.
Ferrosilicomanganese	4,002	6,247	--	Norway 6,069; West Germany 178.
Ferrosilicon	2,774	3,166	--	Norway 2,503; West Germany 525; Sweden 138.
Silicon metal	853	622	--	Norway 456; France 112; West Germany 54.
Unspecified	971	449	2	West Germany 267; Belgium-Luxembourg 63; Norway 59.
Steel, primary forms	218,643	163,359	(2)	Finland 37,796; Sweden 29,028; West Germany 27,816.
Semimanufactures:				
Bars, rods, angles, shapes, sections	357,280	379,213	61	Sweden 92,100; West Germany 70,763; United Kingdom 39,195.
Universals, plates, sheets	717,213	693,230	27	Sweden 136,423; West Germany 122,424; Finland 87,742.
Hoop and strip	73,781	77,075	1	West Germany 37,070; Sweden 17,536; Austria 7,926.
Rails and accessories	9,414	13,130	--	West Germany 9,363; France 3,303; Sweden 227.
Wire	37,737	36,830	8	West Germany 11,924; Belgium-Luxembourg 11,305; Sweden 6,037.
Tubes, pipes, fittings	282,487	270,995	647	West Germany 109,309; United Kingdom 25,126; Netherlands 23,457.
Castings and forgings, rough	5,413	6,567	4	West Germany 2,427; Norway 1,725; Switzerland 756.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Lead:				
Oxides	355	308	2	West Germany 214; East Germany 41; Belgium-Luxembourg 23.
Ash and residue containing lead	--	10	--	All from Sweden.
Metal including alloys:				
Scrap	994	339	--	Sweden 157; United Kingdom 83; Netherlands 56.
Unwrought	20,468	19,533	--	Sweden 8,488; West Germany 8,459; Belgium-Luxembourg 1,646.
Semimanufactures	4,249	4,977	(2)	West Germany 4,523; France 263; Sweden 92.
Lithium: Metal including alloys, all forms	2	4	--	West Germany 2.
Magnesium: Metal including alloys:				
Scrap	202	12	--	Sweden 10; West Germany 2.
Unwrought	107	79	--	Norway 76; West Germany 1; Italy 1.
Semimanufactures	111	172	33	Netherlands 54; Switzerland 28.
Manganese:				
Ore and concentrate, metallurgical-grade	1,085	575	--	Netherlands 527; West Germany 48.
Oxides	1,541	1,388	--	Belgium-Luxembourg 769; Greece 340; Netherlands 195.
Metal including alloys, all forms	3	39	--	Norway 28; Sweden 8; China 2.
Mercury 76-pound flasks	464	203	--	U.S.S.R. 87; Turkey 58; Finland 29.
Molybdenum:				
Oxides and hydroxides	1	35	--	Netherlands 32; West Germany 1; United Kingdom 1.
Metal including alloys:				
Unwrought	(2)	1	--	Mainly from United Kingdom.
Semimanufactures	(2)	3	--	Mainly from West Germany.
Nickel:				
Ore and concentrate	--	12	--	Netherlands 7; Switzerland 5.
Oxides and hydroxides	1	1	--	All from West Germany.
Metal including alloys:				
Scrap	--	2	--	Mainly from West Germany.
Unwrought	145	216	--	Finland 126; West Germany 41; United Kingdom 19.
Semimanufactures	194	280	44	West Germany 113; Norway 45.
Platinum-group metals:				
Waste and sweepings value, thousands	$104	$409	--	Sweden $393; Finland $7; United Kingdom $5.
Metals including alloys, unwrought and partly wrought do	$4,357	$6,036	$66	Netherlands $2,143; Switzerland $1,576; United Kingdom $1,127.
Rare-earth metals including alloys, all forms	--	(2)	--	All from Sweden.
Rhenium: Metal including alloys, all forms	(2)	(2)	--	All from Switzerland.
Selenium, elemental	1	(2)	--	All from West Germany.
Silver:				
Waste and sweepings[3] value, thousands	r$1,700	$1,488	--	Norway $919; Sweden $537; Iceland $20.
Metal including alloys, unwrought and partly wrought do	$10,267	$10,164	$12	France $2,657; West Germany $2,191; Switzerland $2,170.
Tellurium, elemental and arsenic	--	(2)	--	All from Canada.
Tin:				
Oxides	1	1	--	All from United Kingdom.
Ash and residue containing tin	39	--		
Metal including alloys:				
Scrap	2	504	500	Norway 4.
Unwrought	362	1,999	937	Belgium-Luxembourg 773; West Germany 187.
Semimanufactures	259	141	(2)	Sweden 69; West Germany 52; United Kingdom 15.
Titanium:				
Oxides	8,281	8,605	240	United Kingdom 2,949; Norway 2,642; Finland 1,311.
Metal including alloys:				
Scrap	--	(2)	--	All from Japan.
Unwrought	(2)	(2)	(2)	
Semimanufactures	62	64	7	West Germany 45; Japan 8; Sweden 3.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Tungsten: Metal including alloys:				
Scrap	8	13	--	United Kingdom 10; Sweden 2; West Germany 1.
Unwrought	1	2	--	Mainly from West Germany.
Semimanufactures	10	13	(2)	Sweden 9; United Kingdom 2; West Germany 1.
Uranium and/or thorium: Metal including alloys, all forms, thorium	--	(2)	--	All from West Germany.
Vanadium:				
Oxides and hydroxides	--	1	--	All from Netherlands.
Metal including alloys:				
Unwrought	--	3	3	
Semimanufactures	--	(2)	--	All from Japan.
Zinc:				
Oxides	2,763	3,117	545	West Germany 1,872; France 360.
Blue powder	847	896	--	Norway 577; Belgium-Luxembourg 177; West Germany 142.
Ash and residue containing zinc	172	155	--	All from West Germany.
Metal including alloys:				
Scrap	52	86	--	West Germany 54; Finland 30; Cyprus 2.
Unwrought	14,574	14,738	--	Finland 6,084; Norway 5,343; United Kingdom 1,448.
Semimanufactures	3,793	4,062	--	France 2,531; West Germany 1,303; Norway 50.
Zirconium:				
Ore and concentrate	236	256	--	West Germany 206; Netherlands 48; United Kingdom 2.
Metal including alloys, all forms	(2)	(2)	(2)	
Other:				
Ores and concentrates	98	22	--	Canada 20; West Germany 2.
Oxides and hydroxides	6	11	(2)	Netherlands 3; Spain 2; United Kingdom 2.
Ashes and residues	97	1	--	All from Sweden.
Base metals including alloys, all forms	1	--		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	10,331	10,468	4	Iceland 9,583; Netherlands 318; West Germany 236.
Artificial:				
Corundum	374	451	--	West Germany 443; France 6; United Kingdom 1.
Silicon carbide	969	752	--	Norway 504; West Germany 246; France 2.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$368	$791	$74	Switzerland $506; Ireland $195.
Grinding and polishing wheels and stones	1,205	1,222	4	West Germany 371; Austria 316; Italy 109.
Asbestos, crude	10,362	10,269	50	Canada 8,702; Cyprus 935; Greece 582.
Barite and witherite	1,914	14,566	--	Netherlands 6,130; Ireland 5,350; Norway 1,966.
Boron materials:				
Crude natural borates	4,704	2,599	1,940	Belgium-Luxembourg 466; West Germany 101.
Oxides and acids	433	480	60	France 168; Italy 106; Turkey 62.
Bromine	130	76	14	Israel 41; United Kingdom 18.
Cement	63,382	74,933	1	Poland 38,643; West Germany 14,796; East Germany 12,477.
Chalk	15,246	16,113	4	West Germany 7,915; France 3,523; Austria 2,397.
Clays, crude:				
Bentonite	2,669	4,780	275	West Germany 1,499; Netherlands 1,108; Italy 1,073
Chamotte earth	4,558	1,255	--	France 1,030; West Germany 162; Netherlands 35.
Fuller's earth	1,129	750	--	West Germany 294; United Kingdom 256; Netherlands 199.
Kaolin	36,182	29,750	8	United Kingdom 25,343; West Germany 3,097; Czechoslovakia 438.
Unspecified	r6,426	6,442	300	West Germany 5,640; Netherlands 456.
Cryolite and chiolite	111,530	70,343	--	Greenland 70,342; Iceland 1.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Diamond:				
Gem, not set or strung value, thousands	$2,459	$6,109	--	Belgium-Luxembourg $3,060; Sweden $2,018; Switzerland $427.
Industrial stones ---do---	$39	$151	--	Belgium-Luxembourg $143; Switzerland $4; Israel $2.
Diatomite and other infusorial earth	5,536	5,126	1,936	Iceland 1,956; France 333.
Feldspar, fluorspar, related materials:				
Feldspar	6,558	4,993	--	Norway 4,201; Sweden 602; West Germany 106.
Fluorspar	499	486	--	East Germany 360; Sweden 74; France 44.
Unspecified	56	119	(2)	West Germany 104; Belgium-Luxembourg 6; Netherlands 5.
Fertilizer materials:				
Crude, n.e.s	514	501	--	West Germany 415; Sweden 75; France 11.
Manufactured:				
Ammonia	354,938	306,424	--	Trinidad and Tobago 115,758; West Germany 110,507; U.S.S.R. 26,956.
Nitrogenous	176,780	253,625	--	Sweden 52,049; Romania 46,864; Yugoslavia 46,281.
Phosphatic	4,815	6,719	--	West Germany 2,703; Netherlands 1,653; Morocco 988.
Potassic	288,541	253,567	15,928	West Germany 99,818; Canada 69,689; East Germany 59,004.
Unspecified and mixed	621,729	539,168	31,308	Norway 237,473; Romanina 71,818; Netherlands 36,397.
Graphite, natural	1,316	1,388	35	West Germany 1,303; Switzerland 43.
Gypsum and plaster	158,825	208,765	31	Spain 183,944; West Germany 23,872; Sweden 366.
Iodine	4	6	--	West Germany 5; Japan 1.
Kyanite and related materials	641	661	(2)	West Germany 453; Sweden 102; Netherlands 100.
Lime	19,908	42,121	--	West Germany 25,577; Sweden 8,904; Belgium-Luxembourg 7,361.
Magnesium compounds:				
Magnesite, crude	--	6	--	All from Norway.
Oxides and hydroxides	10,121	12,312	108	China 6,264; Austria 3,653; Norway 1,088.
Other	78,963	49,827	--	East Germany 43,316; West Germany 6,511.
Mica:				
Crude including splittings and waste	273	258	--	United Kingdom 98; West Germany 64; Norway 48.
Worked including agglomerated splittings	61	50	--	Belgium-Luxembourg 40; France 4; India 2.
Phosphates, crude	328,663	198,474	22,300	Morocco 99,977; Republic of South Africa 68,848.
Pigments, mineral:				
Natural, crude	475	181	5	Cyprus 163; United Kingdom 5.
Iron oxides and hydroxides, processed	4,850	4,551	24	West Germany 3,747; Spain 403; Italy 195.
Potassium salts, crude	3,350	2,739	--	All from West Germany.
Precious and semiprecious stones other than diamond:				
Natural ----- value, thousands	$1,106	$4,652	$58	Sweden $3,169; West Germany $546; Belgium-Luxembourg $321.
Synthetic ---do---	$185	$68	$26	Switzerland $29; West Germany $7.
Pyrite, unroasted	80	71	--	Norway 70; West Germany 1.
Salt and brine	304,656	333,584	35	West Germany 100,702; U.S.S.R. 78,624; East Germany 71,543.
Sodium compounds, n.e.s.: Carbonate, manufactured	50,369	48,709	--	West Germany 20,892; Netherlands 13,450; East Germany 11,207.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	429,616	201,630	34	Sweden 111,175; Norway 79,594; West Germany 8,957.
Worked	43,396	58,949	--	Portugal 24,007; Sweden 15,063; Italy 8,200.
Dolomite, chiefly refractory-grade	35,234	41,788	--	Norway 25,549; Sweden; 8,389; West Germany 6,236.
Gravel and crushed rock	909,212	982,478	--	Sweden 620,570; Norway 347,083; West Germany 12,153.
Limestone other than dimension	185,997	201,372	--	United Kingdom 109,196; Sweden 91,282; West Germany 427.
Quartz and quartzite	30,433	17,700	6	Sweden 16,234; West Germany 784; Norway 605.
Sand other than metal-bearing	101,345	96,714	2	Sweden 40,368; Belgium-Luxembourg 28,628; Norway 14,789.
Sulfur:				
Elemental:				
Crude including native and by-product	72,939	40,896	20	West Germany 40,486; Poland 204; United Kingdom 185.
Colloidal, precipitated, sublimed	122	174	--	West Germany 173; United Kingdom 1.
Dioxide	1,165	1,129	--	West Germany 635; Sweden 315; Norway 179.
Sulfuric acid	12,226	25,765	--	Finland 16,025; West Germany 7,291; Norway 1,850.
Talc, steatite, soapstone, pyrophyllite	9,971	9,662	292	Finland 3,835; Norway 2,299; Austria 1,405.
Vermiculite, perlite, chlorite	5,697	7,901	(2)	Republic of South Africa 4,829; Turkey 1,550; Greece 1,340.
Other:				
Crude	12,892	15,093	1,028	Norway 7,668; Sweden 2,624; West Germany 1,672.
Slag and dross, not metal-bearing	30,282	70,318	--	Norway 33,163; United Kingdom 15,711; Belgium-Luxembourg 7,417.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	5,971	3,575	193	Netherlands 1,383; United Kingdom 1,272; West Germany 416.
Carbon:				
Carbon black	4,702	4,474	57	Sweden 2,820; Netherlands 810; West Germany 580.
Gas carbon	400	270	--	West Germany 167; East Germany 63; Netherlands 10.
Coal:				
Anthracite thousand tons	6	2	(2)	Mainly from West Germany.
Bituminous do.	12,706	12,145	(2)	Poland 103; United Kingdom 7; unspecified 12,030.
Briquets of anthracite and bituminous coal do.	1	5	4	Australia 1.
Lignite including briquets do.	46	34	(2)	East Germany 28; West Germany 6.
Coke and semicoke do.	77	70	4	France 26; West Germany 14; Belgium-Luxembourg 11.
Gas, natural: Gaseous million cubic feet	1	1	1	
Peat including briquets and litter	24,653	31,441	15	Sweden 12,254; West Germany 10,995; U.S.S.R. 5,487.
Petroleum:				
Crude thousand 42-gallon barrels	34,700	31,395	--	Kuwait 14,421; United Kingdom 9,526; Norway 3,451.
Refinery products:				
Liquefied petroleum gas do.	1,304	671	(2)	Sweden 216; United Kingdom 194; Norway 174.
Gasoline do.	6,318	5,698	11	Sweden 3,194; Finland 823; Netherlands 468.
Mineral jelly and wax do.	85	95	(2)	West Germany 57; China 8; United Kingdom 7.
Kerosene and jet fuel do.	5,987	5,260	--	Netherlands 1,543; United Kingdom 951; Norway 522.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products —Continued				
Distillate fuel oil thousand 42-gallon barrels	21,095	19,399	(2)	Sweden 6,772; Norway 3,601; U.S.S.R. 2,247.
Lubricants ---------do----	1,267	1,875	7	U.S.S.R. 967; Netherlands 250; West Germany 238.
Residual fuel oil ------do----	10,080	10,720	322	Sweden 2,627; U.S.S.R. 2,169; United Kingdom 2,023.
Bitumen and other residues do----	1,251	1,293	(2)	Sweden 509; West Germany 357; Netherlands 213.
Bituminous mixtures---do----	13	17	(2)	West Germany 8; Sweden 3; United Kingdom 3.
Petroleum coke ------do----	1,743	2,346	NA	NA.

[r]Revised. NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

COMMODITY REVIEW

Industrial Minerals.—*Cement.*—A/S Aalborg Portland-Cement-Fabrik, Denmark's only cement producer, continued construction of its 4,000-ton-per-day, semidry, gray portland cement kiln in its Rordal plant in Aalborg as a replacement for the current three smaller kilns. The new kiln was expected to be operating by late summer 1988. The estimated construction cost was $65 million. Aalborg was the largest world producer and exporter of white cement. Exports, all white cement, increased to a record high 360,000 tons. Lowered total cement production was caused by decreased domestic demand in housing and industrial construction. Aalborg continued to increase both its trucking and ocean fleets for shipping of bulk cement, coal, and fly ash. The company was Denmark's largest industrial consumer of coal, although accounting for only about 5% of Denmark's total coal consumption. A total of 463,000 tons of fly ash from Danish powerplants was transported to cement and concrete industries in Denmark and Norway.

Fertilizer Materials.—Finland's Kemira Oy acquired 65% of financially troubled Superfos A/S, Denmark's sole fertilizer producer, effective January 1, 1987. A new company, Superfos Goedning A/S, was formed in the joint venture to manufacture and market fertilizers in Denmark and to handle those fertilizer plants and marketing operations in the Federal Republic of Germany that were formerly held by the Danish company. Total sales of the new company, 65% owned by Kemira and 35% owned by Superfos, were expected to exceed 1 million tons of NPK and PK fertilizers. Raw materials were to be supplied by Kemira.

Superfos A/S sold Royster Co., its U.S. subsidiary in Florida, to Cedar Holdings Inc. of Connecticut near midyear. Losses from Royster had been particularly heavy mainly because of low prices for its major product, diammonium phosphate.

Mineral Fuels.—The major objective of Denmark's energy policy continued to be the reduction of net oil imports. This goal had been partially met by conversion of most electrical powerplants to coal, development of Danish North Sea oil and gas production, and energy conservation. About 93% of electrical energy in 1986 was produced from coal, all of which was imported. The 1986 consumption breakdown for all end uses was oil, 52%; coal, 38%; gas (none imported), 6%; other (none imported), 4%. Approximately 64% of oil consumption was provided by net imports of crude and refined oil products. The balance came from Danish North Sea crude. Production of oil and gas each increased significantly, reaching record levels. The Danish North Sea provided more than 25% of Denmark's total energy requirements. About one-half of crude oil consumption was supplied indigenously. The total value of Danish North Sea oil and gas production was about $1

billion in 1987. However, the accumulated investment in North Sea petroleum development, about $5 billion, had not yet been recovered. The recovery was delayed by the 1986 collapse of oil prices, and little corrective headway was made during 1987. Full recovery of the investment was not expected by the Finance Ministry until the early 1990's, depending on world market prices for oil.

Coal.—Danish policy had been to import coal from several countries to provide source stability. Australian coal had become the major source by yearend 1986 after termination of the Republic of South Africa's one-quarter import share. The landing price of U.S. coal in Denmark was approximately 40% above that of Australian coal during early 1987.

Natural Gas.—The Tyra Field in the Danish North Sea was the principal producer of Danish gas, which was piped to the mainland together with coproduct gas from Danish North Sea oil wells. Tyra also produced a significant quantity of condensate, roughly 1 million barrels per year, which was piped to the mainland via the Gorm Oilfield. Government approval was obtained for development by the Dansk Undergrunds Consortium (DUC) of the Igor Gasfield, a satellite of the producing Dan Oilfield. However, the development schedule was not firm and was expected to be influenced by gas supply and demand, both foreign and domestic. Government-owned Dansk Olie og Naturgas A/S, the domestic gas distributor, began negotiations to procure more gas from domestic and Norwegian sources. Construction of the domestic gasline network was completed by finishing a 40-mile line from Lille Torup north to Aalborg and a 20-mile line from Silkborge to Skjoldelev.

Petroleum.—Production of crude petroleum, all from the Danish North Sea, increased significantly as it had done each year since 1980. Construction of Dan-F, an extension of the Dan Field, was completed. Production began in the spring. Overall production from the Dan Field was approximately quadrupled to 33,000 barrels per day and overall Danish production exceeded 100,000 barrels per day for the first time. Estimated proven reserves were limited but appeared to be sufficient to last until the end of the century. Other unproven resources were known.

DUC continued to control all significant gas and oil field development and production in the Danish North Sea. It consisted of A. P. Moller (operator), 39%; Shell Olie og Gasundvinding Danmark BV, 46%; and Texaco A/S, 15%. Crude oil was pumped from four fields during 1987. The Gorm Field, the largest, accounted for nearly 40% of production; the Dan Field and the Skjold Field each produced about 30%; and the small new Rolf Field produced about 2%.

DUC submitted for approval a $76 million development plan to the Government at yearend to increase oil production from the Gorm Field by water injection. Reserves were nearing exhaustion. Four injection holes and two new producing wells were to be drilled, with production startup planned for 1989. Treated seawater would be piped from the Skjold Field where water injection was already in use. An expected production increase of 4,000 barrels of oil per day offset a projected decline.

DUC also intended to try to increase output from the Dan Field by drilling a horizontal well from the ocean floor into a limestone layer at a depth of 5,600 feet. The project was to require two doglegs. If the approach proved successful, more similar holes would be drilled. Two new wells and a new pipeline were under construction in the Skjold Field. This enlargement was scheduled for startup in 1988.

The Government approved development of the Kraka Oilfield, a 20- to 100-million-barrel reserve. Startup was scheduled for 1992.

DUC retested Gert-1, an exploration well drilled and subsequently abandoned in 1984 about 50 miles northwest of the Gorm Oilfield near the border of the Danish and Norwegian North Seas. The reentry flowed at a rate of 4,000 barrels per day. Oil recordings had also been made in 1984. Interest in Gert was regained after Norsk Hydro A/S drilled with success on the Norwegian side of the line, showing a 100- to 200-million-barrel structure that extended into the Danish North Sea. A new well, Gert-3, completed in the fall, failed to show sufficient hydrocarbons to warrant further testing. Gert-2, drilled in 1985, was dry. Further exploration in the Gert area appeared to be imminent. DUC also drilled deeply to explore below the chalk reservoir of the Gorm Oilfield. However, these wells were dry.

In response to the Government's decision to relinquish DUC's exclusive exploration concession over all Danish acreage, two U.S. firms, Amoco Denmark Exploration Co. and Phillips Petroleum Co. Norway, conducted exploratory drillings in Danish waters. Amoco's small discovery in Block 5504/1 made it the first non-DUC operator to find oil in the Danish sector.

GREENLAND

A new ore body was brought into production near the Black Angel Mine, thereby assuring production of lead and zinc concentrates through 1989. The cryolite mine at Ivigtut was closed at yearend.

The Government of Greenland was in financial difficulty by yearend, primarily because of large expenditures to improve its fishing fleet. The Danish Government gave Greenland a $100 million advance at yearend, equal to six regular monthly grants. One-half of this was sent directly to creditor institutions.

The Geological Survey of Greenland continued its field explorations for minerals in southern Greenland, and a program was initiated by the Governments of Denmark and Greenland to attract foreign firms to exploit mineral deposits in the area. The Geological Survey confirmed the existence of a large deposit of columbium and also discovered lanthanum-bearing deposits. A consortium of three Canadian firms was given exclusive rights to explore for lanthanum in a specific area.

Table 4.—Greenland: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
Cryolite, crude ore[2]	46,500	67,200	111,500	70,343	38,185
Lead: Concentrate, Pb content	21,600	17,800	17,800	16,200	20,500
Silver: In lead concentrate, Ag content[e] thousand troy ounces	492	334	276	385	418
Zinc: Concentrate, Zn content	79,200	71,300	70,300	62,100	69,200

[e]Estimated. [p]Preliminary.
[1]Table includes data available through June 30, 1988.
[2]Shipments.

Table 5.—Greenland: Exports of mineral commodities[1]

(Metric tons)

Commodity	1985	1986	Principal destinations, 1986
METALS			
Aluminum: Metal including alloys, scrap	1	2	All to Denmark.
Copper: Metal including alloys, scrap	39	35	Do.
Iron and steel: Metal:			
Scrap	18	19	Do.
Semimanufactures, tubes, pipes, fittings	3	1	Do.
Lead: Ore and concentrate	26,313	9,001	West Germany 7,401; France 1,600.
Zinc: Ore and concentrate	121,621	49,590	West Germany 16,618; France 14,700; Finland 12,075.
Other: Base metals including alloys, all forms	--	(2)	All to Denmark.
INDUSTRIAL MINERALS			
Diamond: Gem, not set or strung value, thousands	--	$3	Do.
Precious and semiprecious stones other than diamond, natural do	--	$3	Do.
Stone, sand and gravel: Dimension stone:			
Crude and partly worked	22	--	
Worked	1	2	Do.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline 42-gallon barrels	1,224	1,165	NA.
Kerosene and jet fuel do	43,323	49,174	NA.
Distillate fuel oil do	--	1,829	NA.

NA Not available.
[1]Table prepared by Jozef Plachy. Greenland did not report any exports of mineral commodities to the United States during 1986.
[2]Less than 1/2 unit.

Table 6.—Greenland: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys, semimanufactures	62	70	(2)	Denmark 50; Norway 14; West Germany 4.
Copper: Metal including alloys:				
Unwrought	(2)	--		
Semimanufactures	91	69	(2)	Denmark 62; West Germany 6; Sweden 1.
Iron and steel: Metal:				
Scrap	--	11	--	All from Denmark.
Pig iron, cast iron, related materials	2	13	--	All from Brazil.
Steel, primary forms	--	(2)	--	All from West Germany.
Semimanufactures:				
Bars, rods, angles, shapes, sections	2,896	3,724	--	Denmark 3,204; Belgium-Luxembourg 357; Sweden 115.
Universals, plates, sheets	557	672	--	Denmark 555; Sweden 54; West Germany 33.
Hoop and strip	10	3	--	Denmark 2; Finland 1.
Rails and accessories	15	7	--	Norway 6; Finland 1.
Wire	17	52	--	United Kingdom 23; Switzerland 18; Denmark 8.
Tubes, pipes, fittings	1,332	1,462	1	Denmark 1,356; West Germany 54; Sweden 37.
Castings and forgings, rough	333	186	--	Denmark 184; Netherlands 1; Norway 1.
Lead: Metal including alloys:				
Unwrought	4	14	--	Sweden 13; Denmark 1.
Semimanufactures	2	2	--	Mainly from Denmark.
Nickel: Metal including alloys, semimanufactures	(2)	(2)	--	All from Switzerland.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$13	$43	--	United Kingdom $34; Republic of South Africa $9.
Silver: Metal including alloys, unwrought and partly wrought do.	$12	$16	--	Denmark $8; Netherlands $3; United Kingdom $3.
Tin: Metal including alloys:				
Unwrought	--	(2)	--	All from Denmark.
Semimanufactures	(2)	(2)	--	Do.
Zinc:				
Oxides	(2)	(2)	--	Do.
Metal including alloys, semimanufactures	28	20	--	Do.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	3	--		
Cement	9,760	12,975	--	Denmark 12,931; Iceland 36; Greece 7.
Clays, crude	25	7	2	Denmark 3; United Kingdom 2.
Diamond: Gem, not set or strung value, thousands	$7	$28	--	Republic of South Africa $14; Denmark $12; Belgium-Luxembourg $1.
Diatomite and other infusorial earth	2	2	--	All from Denmark.
Fertilizer materials: Manufactured:				
Ammonia	8	4	--	Denmark 3.
Nitrogenous	1,136	20	--	All from Denmark.
Phosphatic	15	--		
Unspecified and mixed	272	272	--	Denmark 271; Sweden 1.
Gypsum and plaster	2	1	--	All from Denmark.
Lime	897	813	--	Do.
Phosphates, crude	--	3	--	Do.
Precious and semiprecious stones other than diamond, natural value, thousands	$1	$3	$2	Denmark $1.
Salt and brine	4,678	3,331	--	Denmark 3,137; West Germany 193.
Sodium compounds, n.e.s.: Carbonate, manufactured	13	15	--	Denmark 11; West Germany 2.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	10	3	--	Canada 1; Denmark 1; Italy 1.
Worked	109	3	(2)	Denmark 2; Austria 1.
Dolomite, chiefly refractory-grade	7	--		
Gravel and crushed rock	22	32	--	Switzerland 26; Denmark 6.
Quartz and quartzite	45	--		
Sand other than metal-bearing	507	277	--	Denmark 274; Switzerland 3.

See footnotes at end of table.

Table 6.—Greenland: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur: Sulfuric acid	18	33	--	Denmark 28; United Kingdom 4; West Germany 1.
Talc, steatite, soapstone, pyrophyllite	1	1	--	All from Denmark.
Other:				
Crude	78	80	--	Denmark 71; Sweden 8.
Slag and dross, not metal-bearing	10	20	--	All from Denmark.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	18	15	--	Do.
Coal: Anthracite and bituminous	296	148	--	All from Poland.
Peat including briquets and litter	11	10	--	All from Denmark.
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	1,288	742	--	Denmark 731; West Germany 6; France 5.
Gasoline do	51,357	63,147	--	Denmark 63,096; Belgium-Luxembourg 34; Sweden 9.
Mineral jelly and wax do	[2]	[2]	NA	NA.
Kerosene and jet fuel do	69,789	52,220	--	Netherlands 27,389; Denmark 24,831.
Distillate fuel oil do	1,160,284	718,659	--	Denmark 467,705; Sweden 208,716; Norway 42,231.
Lubricants do	12,019	11,123	49	Denmark 9,527; United Kingdom 1,176; Sweden 140.
Residual fuel oil do	--	21,658	--	All from Denmark.
Bitumen and other residues do	1,442	5,902	--	Do.
Bituminous mixtures do	1,345	1,079	--	Denmark 1,073.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.

COMMODITY REVIEW

Metals.—Boliden AB brought a new nearby ore body, Nunngarat, into production, thereby assuring production of lead and zinc concentrates through 1989 at its Black Angel Mine. No significant exploration was conducted during 1987. Exploration conducted in the Deep Ice Zone during 1986 had been disappointing.

The Danish Government granted exclusive rights to a Canadian consortium of three mining companies to explore for lanthanides in a 100-square-mile area within the Gardar geological province in southwestern Greenland. Lanthanum is used in the production of superconducting ceramic materials. The area is easily accessible yearround by ship and is near an international airport. Field exploration conducted during 1986 by the Geological Survey of Greenland revealed five alkaline intrusives within the area with lanthanide enrichment in the mineral pyrochlore.

Exploration by the Geological Survey of Greenland proved the existence of a significant columbium-tantalum deposit in the Motzfeldt alkaline ring complex in Greenland's southernmost tip, also within the Gardar geological province. An estimated 130 million tons of ore containing 0.4% to 1.0% Cb_2O_5 with minor amounts of tantalum and uranium within a pyrochlore mineral phase was identified. Large reserves of zirconium and rare-earth metal findings were also reported. The fieldwork of the Geological Survey was supported by the Danish Government.

Industrial Minerals.—The last shipment to Denmark of crude ore containing nearly 40% cryolite was made in December as total exports during the year decreased by almost 50%. Cryolite mining ceased at Ivigtut after producing 15,000 tons of ore during 1987. The mine-closure decision caused consternation in Denmark and Greenland. After nearly 50 years of partnership, the Danish Government had sold its 50% share in the mining company to the other operator, Kryolitselskabet Oresund A/S, at yearend 1986 on the premise that reserves had been depleted. However, soon thereafter the Government began an inquiry into the circumstances surrounding the sale. Data released

at about that time indicated a remaining estimated reserve of 1.5 million tons of ore containing 12% cryolite and 20% fluorite. In addition, deep drilling nearby during 1987 by Kryolitselskabet Oresund intersected a cryolite-bearing granite similar to that which had been mined at Ivigtut. Meanwhile, the company's position was that further mining was not profitable because of the low mineral contents of the available ores.

Mineral Fuels.—The consortium that had previously explored for oil in Jameson Land in eastern Greenland resumed seismic and gravimetric surveys after renegotiating its agreement with the Government of Greenland. The consortium operator was A/S Arco Greenland. Deep drilling was postponed until 1990.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Danish krone (DKr) to U.S. dollars at the rate of DKr6.9 = US$1.00, the average for 1987.

The Mineral Industry of Egypt

By T. John Rowland[1]

The petroleum sector continued to be the dominant contributor to the Egyptian gross domestic product (GDP) and supplied Egypt's only mineral commodity of international significance. During the year, increased prices for oil enhanced Egyptian petroleum export earnings. Iron ore, phosphate rock, and a variety of other industrial minerals were produced principally for domestic consumption in 1987.

In May, Egypt obtained assistance from the International Monetary Fund (IMF), which approved the Government's economic reform program, principally Egypt's policies on the exchange rate, energy subsidies, and price controls in agriculture and industry. As a result of the IMF approval, the Paris Club, a group of international creditors, rescheduled about $8 billion[2] of Egyptian debt-service payments for 10 years. The agreement included provisions for lowering the interest rate charged on some official loans. The Planning and International Cooperation Ministry designated three areas for negotiations: North America; Europe and other Arab states; and Asia, the Far East, and Australia.

PRODUCTION AND TRADE

The agreement between Egypt and the IMF provided the foundation for an $8 billion 10-year rescheduling of Egypt's official debts to Western countries. This agreement, including a 5-year grace period on debt payments, was expected to assist the performances of the four principal areas of Egyptian foreign exchange: oil exports, foreign remittances, tourism, and Suez Canal dues. A new Egyptian 5-year plan targeted a 5.8% annual Egyptian growth rate and a GDP increase to $40 billion in 1991-92 from the $30 billion level of 1986-87. Investments from the private sector were expected to be a major factor; they would represent about 40% of the plan's total investment. When implemented, external financing for the public-sector investment would be nearly two-thirds domestic, with the remainder from foreign grants and loans.

As in previous years, the United States was Egypt's principal trade partner. Petroleum accounted for more than 40% of the Egyptian exports to the United States. Agricultural products were the most dominant component of Egyptian imports from the United States.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
METALS					
Aluminum metal	140,194	[r]170,000	208,587	175,000	179,000
Copper, refined, secondary	2,400	2,600	2,600	2,500	[e]2,500
Iron and steel:					
Iron ore and concentrate thousand tons	2,223	2,500	87	2,135	2,048
Pig iron do	196	225	225	121	46
Crude steel do	125	200	533	281	350
Semimanufactures do	378	500	500	NA	NA
Ferroalloys: Ferrosilicon[e]	6,000	7,500	7,500	[2]7,221	[2]7,700
INDUSTRIAL MINERALS					
Asbestos	245	325	229	476	209
Barite	3,185	3,500	4,426	3,385	4,116
Cement: Hydraulic thousand tons	5,500	6,500	5,749	7,612	8,746
Clays:					
Bentonite	2,512	3,000	3,000	5,126	3,827
Fire clay	205,000	250,000	250,000	364,300	148,727
Kaolin	100,176	120,000	108,378	127,784	125,256
Feldspar, crude	5,945	7,281	19,073	19,287	16,000
Fluorspar	12	[r]810	85	80	776
Gypsum and anhydrite, crude	721,340	750,000	841,467	905,688	1,088,472
Lime	93,660	97,500	97,000	--	--
Nitrogen: N content of ammonia thousand tons	905	686	684	680	788
Phosphate: Phosphate rock do	[r]647	1,043	1,074	1,271	1,167
Salt, marine do	918	1,000	1,061	976	1,012
Sodium compounds:					
Sodium carbonate	43,000	40,000	49,108	[e]50,000	4,000
Sodium sulfate	1,950	[e]30,000	66,830	18,940	42,484
Stone, sand and gravel:					
Basalt thousand cubic meters	NA	100	720	899	1,044
Dolomite[e] thousand tons	500	500	500	500	500
Granite, dimension cubic meters	NA	4,000	4,000	2,938	2,000
Gravel thousand cubic meters	7,000	7,500	10,736	11,214	[e]11,200
Limestone and other calcareous n.e.s do	9,276	10,000	12,059	13,476	14,785
Marble blocks (including alabaster) cubic meters	16,400	17,500	43,312	40,000	27,814
Quartz	NA	7,500	7,500	NA	NA
Sand including glass sand thousand cubic meters	166	1,500	12,677	13,122	246
Sandstone do	613	710	486	475	417
Sulfur:					
Elemental, byproduct[e]	1,000	1,250	3,000	4,000	5,000
Sulfuric acid	44,899	45,000	46,452	55,000	575,301
Talc, steatite, soapstone, pyrophyllite	4,519	12,213	7,700	8,800	[e]9,000
Vermiculite	300	325	488	495	[e]500
MINERAL FUELS AND RELATED MATERIALS					
Coke: Oven and beehive thousand tons	916	950	895	908	[e]900
Gas, natural:					
Gross production million cubic feet	120,000	140,000	172,000	180,000	[e]180,000
Marketed do	95,000	110,000	134,000	155,000	[e]155,000
Petroleum and refinery products:					
Crude thousand 42-gallon barrels	262,486	302,000	319,000	262,800	[e]270,000
Refinery products:					
Gasoline and naphtha do	20,500	25,000	25,000	27,000	[e]27,000
Kerosene and jet fuel do	18,500	20,000	20,000	20,000	[e]20,000
Distillate fuel oil do	25,000	25,000	25,000	30,000	[e]30,000
Residual fuel oil do	70,000	75,000	65,000	60,000	[e]60,000
Lubricants do	1,000	1,000	1,000	1,000	[e]1,000
Liquefied petroleum gas do	2,000	2,500	2,000	5,000	[e]5,000
Asphalt do	2,200	2,500	2,500	2,000	[e]2,000
Unspecified do	800	1,000	1,000	4,500	[e]4,500
Refinery fuel and losses do	6,000	6,500	6,500	6,500	[e]6,500
Total do	146,000	158,500	148,000	156,000	[e]156,000

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through July 15, 1988.
[2]Reported figure.

Table 2.—Egypt: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Unwrought	--	24	--	Saudi Arabia 20; Denmark 4.
Semimanufactures	123,842	101,555	491	Netherlands 56,350; Italy 17,434; Belgium-Luxembourg 6,656.
Copper: Metal including alloys:				
Scrap	--	421	--	All to Italy.
Semimanufactures	--	745	--	Italy 740.
Unspecified	3	--		
Iron and steel:				
Iron ore and concentrate including roasted pyrite	--	30	--	All to Greece.
Metal:				
Pig iron, cast iron, related materials	10,000	--		
Steel, primary forms	--	13,682	--	Belgium-Luxembourg 8,679; Italy 4,973.
Semimanufactures:				
Bars, rods, angles, shapes, sections	498	--		
Universals, plates, sheets	1,469	19,686	--	Belgium-Luxembourg 6,253; Republic of South Africa 5,290; Sudan 3,301.
Wire	8	3	--	All to Sudan.
Tubes, pipes, fittings	28	342	--	Do.
Castings and forgings, rough	28	37	--	Sudan 35.
Zinc:				
Oxides	3	--		
Metal including alloys:				
Unwrought	360	1,262	--	Netherlands 500; Italy 483; Spain 279.
Semimanufactures	400	--		
INDUSTRIAL MINERALS				
Cement	4,346	1,052	--	All to Sudan.
Fertilizer materials: Manufactured, nitrogenous	25,345	13,104	--	China 11,744; Greece 1,340.
Phosphates, crude	141,705	71,770	--	North Korea 47,570; Romania 11,400; Czechoslovakia 10,300.
Pigments, mineral: Iron oxides and hydroxides, processed	6	137	--	Sudan 130.
Precious and semiprecious stones other than diamond: Natural				
value, thousands	--	$5	--	All to Saudi Arabia.
Salt and brine	9,551	13,013	--	Cameroon 5,500; Lebanon 4,321; Italy 3,000.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	--	103	--	Israel 100.
Worked	1	--		
Gravel and crushed rock	--	1,570	--	All to Israel.
Sand other than metal-bearing	30	--		
Sulfur: Elemental, crude including native and byproduct	745	--		
Talc, steatite, soapstone, pyrophyllite	665	843	--	East Germany 603; West Germany 207.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	4	--		
Coal: Anthracite and bituminous	35	--		
Coke and semicoke	31,422	71,816	--	Romania 40,113; Greece 15,200; Turkey 7,569.
Petroleum:				
Crude, thousand 42-gallon barrels	75,665	52,191	1,326	Israel 15,745; Romania 11,395; Italy 8,779.
Refinery products:				
Gasoline, motor do.	--	33	--	Netherlands 15; India 9.
Mineral jelly and wax do.	114	127	36	West Germany 91.
Kerosene and jet fuel do.	5,969	3,797	--	Netherlands 1,479; Italy 1,204; France 775.
Distillate fuel oil do.	1,089	965	--	All to bunkers.
Lubricants do.	--	35	--	Do.
Residual fuel oil do.	11,903	12,115	--	Italy 3,633; France 786; bunkers 6,577.
Petroleum coke do.	152	--		

[1]Table prepared by Virginia A. Woodson.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals	1	31	--	All from West Germany.
Aluminum:				
Ore and concentrate	26,111	1,060	--	China 1,000; United Kingdom 60.
Oxides and hydroxides	1,131	27,401	36	Australia 26,232.
Metal including alloys:				
Unwrought	2	--		
Semimanufactures	3,615	3,085	(2)	West Germany 950; Italy 943; France 436.
Chromium: Oxides and hydroxides	55	--		
Cobalt: Oxides and hydroxides	2	10	--	United Kingdom 8; Belgium-Luxembourg 2.
Columbium and tantalum: Metal including alloys, all forms, tantalum value, thousands	--	$32	--	All from United Kingdom.
Copper:				
Matte and speiss including cement copper	--	1,030	--	Zambia 1,000.
Metal including alloys:				
Scrap	6	23	--	Sudan 21.
Unwrought	--	697	--	Switzerland 395; Zambia 283.
Semimanufactures	14,541	9,248	571	United Kingdom 1,691; Netherlands 1,623; Greece 1,456.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	18	67,425	67,344	Morocco 81.
Pyrite, roasted	850	--		
Metal:				
Scrap	2,197	1,539	NA	NA.
Pig iron, cast iron, related materials	49,858	29,196	2,760	U.S.S.R. 10,605; Canada 9,991.
Ferroalloys:				
Ferromanganese	11,016	5,371	--	France 2,010; Switzerland 1,617.
Unspecified	122	93	--	Belgium-Luxembourg 41; Romania 28.
Steel, primary forms	66,311	98,023	5,000	Turkey 40,000; West Germany 16,979; Bulgaria 13,763.
Semimanufactures:				
Bars, rods, angles, shapes, sections	2,045,135	1,674,958	20,349	Romania 582,633; Yugoslavia 240,803; Spain 153,723.
Universals, plates, sheets	328,890	79,810	3,721	Bulgaria 23,111; West Germany 9,680; Belgium-Luxembourg 8,653.
Hoop and strip	23,864	3,183	--	France 1,767; Romania 380.
Rails and accessories	29,071	2,785	--	China 1,923; West Germany 377.
Wire	23,657	15,316	--	Republic of Korea 3,573; China 3,343; Belgium-Luxembourg 2,298.
Tubes, pipes, fittings	84,259	122,842	6,577	Japan 50,496; West Germany 14,132; Republic of Korea 12,668.
Castings and forgings, rough	33,593	24,066	758	Japan 4,416; West Germany 3,008; Austria 2,730.
Lead:				
Oxides	1,302	2,507	--	Bulgaria 840; United Kingdom 760; West Germany 397.
Metal including alloys:				
Scrap	838	375	--	All from Sudan.
Unwrought	16,096	7,710	224	United Kingdom 3,876; Switzerland 1,506; West Germany 746.
Semimanufactures	(3)	5	--	Switzerland 3; France 1.
Magnesium: Metal including alloys:				
Unwrought	15	9	9	
Semimanufactures	18	--		
Manganese:				
Ore and concentrate, metallurgical-grade	--	263	263	
Oxides	2,080	769	18	Belgium-Luxembourg 367; West Germany 157.
Mercury 76-pound flasks	609	551	--	West Germany 522.
Nickel:				
Matte and speiss	40	--		
Metal including alloys:				
Unwrought	11	88	13	United Kingdom 57; Norway 13.
Semimanufactures	20	105	--	Belgium-Luxembourg 73; France 12.
Platinum-group metals: Metals including alloys, unwrought and partly wrought:				
Platinum value, thousands	$190	--		
Unspecified do	--	$35	--	All from United Kingdom.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$143	$162	--	West Germany $134; United Kingdom $24.
Tin: Metal including alloys:				
Scrap	--	3	--	All from United Kingdom.
Unwrought	440	262	--	Malaysia 211; Netherlands 31.
Semimanufactures	8	16	1	Netherlands 13.
Titanium: Oxides	60	424	--	West Germany 234; Italy 169.
Tungsten: Metal including alloys, all forms	3	2	--	Mainly from Netherlands.
Zinc:				
Oxides	1,385	623	(2)	United Kingdom 160; France 143; Spain 104.
Metal including alloys:				
Scrap	5	--		
Unwrought	10,730	11,412	--	Zaire 6,015; France 4,001; Cameroon 1,000.
Semimanufactures	4,935	92	--	Netherlands 60; Denmark 31.
Other:				
Ores and concentrates	3,834	--		
Oxides and hydroxides	94	35	--	United Kingdom 16; Italy 8.
Base metals including alloys, all forms	922	2,521	--	Belgium-Luxembourg 964; Switzerland 795; France 541.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	10	51	--	Greece 40; Japan 10.
Artificial: Corundum	80	79	--	Turkey 68; France 11.
Grinding and polishing wheels and stones	1,406	1,996	--	Italy 1,403; Denmark 328.
Asbestos, crude	13,090	1,949	--	Canada 803; Cyprus 624; Switzerland 522.
Barite and witherite	268	7,281	--	Pakistan 6,924; Turkey 357.
Boron materials: Oxides and acids	309	428	--	Italy 144; Belgium-Luxembourg 100; Turkey 100.
Cement thousand tons	8,804	6,702	56	Greece 1,830; Romania 1,803; Turkey 653.
Chalk	84	265	1	United Kingdom 217; Italy 47.
Clays, crude	51,540	34,593	100	United Kingdom 25,686; Cyprus 2,177.
Cryolite and chiolite	52	--		
Diamond: Industrial stones value, thousands	--	$103	--	All from Belgium-Luxembourg.
Diatomite and other infusorial earth	72	322	--	West Germany 312.
Feldspar, fluorspar, related materials	990	8,331	--	Turkey 6,003; Italy 972; Norway 735.
Fertilizer materials:				
Crude, n.e.s	36	8	8	
Manufactured:				
Ammonia	12	91	--	West Germany 60; France 24.
Nitrogenous	552,803	175,630	847	U.S.S.R. 105,314; Italy 22,688; Bulgaria 22,605.
Potassic	29,046	35,394	--	Switzerland 22,038; Italy 7,135; Belgium-Luxembourg 6,221.
Unspecified and mixed	2,106	442	89	West Germany 195; United Kingdom 132.
Graphite, natural	518	165	--	China 101; Japan 61.
Lime	50	9	--	All from France.
Magnesite, crude	9,210	2,289	5	Austria 2,067.
Mica:				
Crude including splittings and waste	258	28	--	India 27.
Worked including agglomerated splittings	97	4	--	West Germany 1; India 1.
Phosphates, crude	54	--		
Pigments, mineral: Iron oxides and hydroxides, processed	4,984	5,461	55	China 2,025; West Germany 1,580; East Germany 474.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$4	--		
Synthetic do	$6	$3,586	$3,571	France $14.
Pyrite, unroasted	16,100	203	--	All from Turkey.
Salt and brine	1,037	623	--	Netherlands 480; West Germany 129.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	5,231	1,023	--	Romania 1,016.
Sulfate, manufactured	60,110	27,240	--	Romania 11,729; Belgium-Luxembourg 7,494; Italy 5,181.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	26,441	14,047	--	Italy 12,482; Greece 817.
Worked	5,290	1,003	10	Italy 611; France 318.
Dolomite, chiefly refractory-grade	6	380	--	Netherlands 308; Norway 54.
Gravel and crushed rock	712	1,798	--	Italy 1,717; France 75.
Quartz and quartzite	67	33	--	All from West Germany.
Sand other than metal-bearing	3,442	337	--	Belgium-Luxembourg 254; West Germany 75.
Sulfur:				
Elemental:				
Crude including native and by-product	127,132	69,921	13,282	Iraq 56,639.
Colloidal, precipitated, sublimed	26,131	9,060	--	All from Iraq.
Sulfuric acid	52	85	38	France 14; Japan 14.
Talc, steatite, soapstone, pyrophyllite	1,027	975	--	France 310; Norway 267; Finland 255.
Other: Crude	532	447	3	Cyprus 205; Brazil 68; Belgium-Luxembourg 50.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	43	--		
Carbon black	4,237	3,722	186	France 1,447; West Germany 1,327.
Coal: Anthracite and bituminous thousand tons	1,266	1,185	594	U.S.S.R. 422; Australia 169.
Coke and semicoke	5,000	5,019	--	Italy 4,000; France 994.
Peat including briquets and litter	1,822	3,212	--	Ireland 2,074; West Germany 431; Finland 281.
Petroleum refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	1,781	927	(4)	Greece 513; Italy 325.
Gasoline ---do---	(4)	3	--	Netherlands 1; Yugoslavia 1.
Mineral jelly and wax ---do---	48	16	(4)	West Germany 8; Iraq 5.
Kerosene and jet fuel value, thousands	$22,279	$24,258	$151	Kuwait $7,966; France $4,321; Italy $2,746.
Distillate fuel oil thousand 42-gallon barrels	5,777	5,125	--	Israel 1,781; Kuwait 1,320; Bulgaria 109.
Lubricants ---do---	384	679	19	Greece 267; United Kingdom 109; Netherlands 86.
Bituminous mixtures ---do---	1	1	--	Mainly from United Kingdom.

NA Not available.
[1]Table prepared by Virginia A. Woodson.
[2]Unreported quantity valued at $1,000.
[3]Unreported quantity valued at $3,000.
[4]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Gold.—Greenwich Resources PLC of the United Kingdom continued exploration for gold on the El Sid license in Egypt's Eastern Desert, between Luxor, and the Red Sea. Greenwich planned to drill at two locations in Egypt. The first location at Hammaa was identified as a potential gold-bearing massive sulfide body, consisting of hydrothermal auriferous quartz veins about 30 feet wide associated with the Fawakhir granite. Abu Marawat, the second site, was about 10 miles north of a new railroad line linking the Nile Valley to the Red Sea. Exploration at Abu Marawat has identified two veins with gold and silver mineralization. Analysis of three samples from Abu Marawat large-vein structures showed values ranging from 0.78 to 0.99 troy ounce of gold per ton.

Iron and Steel.—Sedimentary deposits of iron ore in the Bahraiya Oasis of the Western Desert were mined by open pit methods. The iron ore was transported by railroad to the Helwan iron and steel complex south of Cairo.

Plans were developed for replacement and modernization of the steel hot-rolling factories of the Egyptian Iron and Steel Co. (EISC) works. Over a 5-year period, iron and steel factory production gradually would be increased from 200,000 to 500,000 tons per year. The Soviet Union agreed to assist with project financing and implementation.

The EISC was involved in another project to increase raw steel output to design capacity of 1.2 million tons per year. Six international companies submitted revised proposals for a contract to install a continuous steel slab caster at the Helwan iron and steel works. The lowest bid reported was an offer of nearly $30 million by Voest-Alpine AG of Austria. Final bid evaluations were expected to be completed by yearend. The continuous slab caster will enable the EISC to eliminate one remelting stage in the steelmaking process.

Construction continued on Alexandria National Iron and Steel Co.'s El Dikheila steelworks, a joint venture between Egypt and Japan. In early 1987, the 800,000-ton-per-year-capacity Midrex direct-reduction plant began operation incorporating a 320,000-ton-per-year rod mill and a 425,000-ton-per-year bar mill. The project was reported to cost $240 million.

National Metal Industries S.A. planned to increase capacity to 125,000 tons per year at the plant in Abu Zaabal about 30 miles northeast of Cairo by modernization of the Sket bar mill. The two 25-ton electric arc furnaces at the Delta Steel Co. in Mostorod were expected to increase capacity to 100,000 tons per year.

INDUSTRIAL MINERALS

Cement.—The cement industry continued to strengthen in 1987. The capacity of the Egyptian domestic cement industry has been reported at 7 million tons per year. The Suez Cement Co. operated two plants, the Suez Cement plant in Suez with a 1-million-ton-per-year capacity and the Quattamia cement plant in Quattamia with a 1.4-million-ton-per-year capacity. The Suez plant, in operation for 4 years, reached 80% capacity in 1987 while the Quattamia plant was scheduled to reach 1.2 million tons in 1988.

After a delay of 2 years, the Helwan Portland Cement Co.'s white cement plant at El Minya became operational with a rated capacity of 200,000 tons per year. The project contractor, Fives-Cail Babcock S.A. of France, also finished performance tests on the Tourah Portland Cement Co.'s 3,300-ton-per-day kiln Line No. 9. The Société des Ciments Française conducted the tests for the contractor.

Assiut Cement Co. accepted kiln line No. 1 from the contractors, Krupp Polysius AG, and BBC Baden. The 5,000-ton-per-day kiln was converted from the wet to the dry process. Additionally, two other 3,700-ton-per-day production lines were under construction in 1987 for Assiut Cement.

National Cement Co.'s second 4,500-ton-per-day kiln line for the El Tabbin cement plant was under construction in 1987. A bypass for the kiln was installed to recover up to 100% of the kiln's waste gases. The bypass was necessary because of the high sulfur content of the fuel and the high chlorine content of the raw material.

Two 3,700-ton-per-day clinker production lines remained under construction at the Helwan Asyut plant, owned by Portland Cement. Helwan Portland Cement canceled original plans for construction of a new plant at Naga Hammadi, northwest of Luxor, but announced plans to integrate the two new clinker production lines into the Asyut plant. Both rotary kilns were being supplied by KHD Humboldt Wedag.

Fertilizer Materials.—The Abu Qir fertilizer complex was scheduled for expansion by the Abu Qir Co. for Fertilizers and Chemicals Industries. The expansion program was to include the design, engineering, and construction of a 254,000-ton-per-year ammonia plant, a 594,000-ton-per-year nitric acid plant, and a 760,000-ton-per-year ammonium nitrate plant. When the work is completed, feedstock for the ammonia plant will be natural gas from the offshore Abu Qir Field. Construction of the complex was scheduled for completion by 1991. The new plants were planned to complement the 286,000-ton-per-year ammonia and 235,000-ton-per-year urea plant at Abu Qir. The existing plant, built by Uhde GmbH, has been operational since 1979.

Technipetrol was awarded a contract for construction of a 109,000-ton-per-year ammonia plant at Suez. Another plant with a 115,000-ton-per-year capacity of ammonium nitrate is at Suez.

Phosphate Rock.—Production of phosphate rock increased in 1987. Egyptian phosphate rock mines are at Sebaiya on the Nile River, south of Luxor, and near Safaga and Quseir. The phosphate rock, averaging 28% P_2O_5, was produced for consumption principally as fertilizer for domestic agricul-

ture.

The Abu Zaabal Fertilizer and Chemical Co. continued expansion activities at the West Sebaiya phosphate mine and phosphoric acid project. Capacity was expected to increase from 120,000 tons per year to 440,000 tons per year.

Sulfur.—The Egyptian Geological Survey and Mining Authority (EGSMA) managed domestic non-oil mineral exploration and development activities of foreign countries. Freeport Sulfur Co. obtained a concession for exploration and development of about 482 square miles on the north Sinai coast. The initial exploration contract period was scheduled for 2 years with a Freeport Sulfur pledge to invest at least $1.0 million. Under the reported contract terms, exploration rights could be extended by Freeport Sulfur by an investment of $1 million per year. In Egypt, royalty payments are required for the commercial development of sulfur. The royalty agreement was reported to include payment to Egypt of 51% of the net proceeds of the first 500,000 tons of sulfur produced. Freeport Sulfur planned to produce about 250,000 tons per year with excess production quantities exported. Egyptian sulfur requirements, for the domestic fertilizer and chemical industries, were approximately 230,000 tons per year.

MINERAL FUELS

Coal.—Egyptian coal reserves, estimated at 80 million tons, were in several small deposits near Suez and the Sinai Peninsula. The major Egyptian coal deposit, in the Sinai Desert near Maghara, was mined from 1964 to 1967. The brown coal ore body was estimated to contain 52 million tons with 27 million tons rated as economical. The mine, destroyed during the 1967 Arab-Israeli war, was undergoing reconstruction during 1987. Mining operations were scheduled to resume by 1990, with the coal produced utilized as fuel for nearby electric generating plants. During the 1990's, the Maghara deposit development was expected to supply up to 600,000 tons of coal per year.

Natural Gas and Petroleum.—The Egyptian General Petroleum Corp. (EGPC) announced that as a result of recent discoveries, Egypt's national oil reserves were 4,685 million barrels and natural gas reserves were 9 trillion cubic feet. EGPC approved plans to commence production at 31 new oilfields and at 8 natural gasfields over the next 5 years. But production operations from the new fields were not planned to raise Egypt's production above the 870,000-barrel-per-day ceiling established in the Egyptian 5-year plan. Production from the various fields would be coordinated to maintain the crude oil production limit. The new discoveries during the year added about 1.4 billion barrels of crude oil and about 4 trillion cubic feet of gas to the Egyptian reserves.

Five international companies obtained concessions to explore for oil and gas in the Western Desert. The EGPC invited bids for six blocks near the Libyan border between the Meleiha concession and Siwa. Exploration agreements were provisionally awarded for exploration of nine blocks. Royal Dutch/Shell NV's local operating company, Shell Winning NV, obtained Block 3, Hamza, and a large portion of Block 4. Norsk Hydro A/S of Norway was also assigned about a one-third portion of Block 4. The Shell acreage included an unexplored section of the Meleiha concession, operated by Agiba Petroleum Co. Offshore, separate provisional concessions were awarded to Amoco Egypt Oil Co., Atlantic Richfield Co., and Continental Oil Co.

Crude oil production averaged 158,700 barrels per day in 1987, a 5% increase from that of 1986. As a result of the increase in the price of crude oil, Amoco increased the number of drill rigs operating in Egypt from four to nine, the highest number in 7 years. In 1987, two sucessful extension wells were drilled in the Ramadan and October Fields. The Ramadan Field well tested at greater than 10,000 barrels of oil per day. Construction of a platform in the October Field was planned for early 1988 to develop an additional productive area. Development of the Badri and El Morgan Fields continued during the year, with completion of expansion facilities expected in early 1988. When completed, the development will accommodate the increased water production from the mature fields.

The liquefied petroleum gas (LPG) complex at Abu Rudais in Sinai was scheduled for expansion. Hitachi Zosem and Nissho-Iwai, a Japanese consortium, received a contract for about $27 million from EGPC for the project. Upon completion in 2 years, the capacity of the complex would be doubled to 50 million cubic feet per day. An LPG plant at Ras Shukhair, on the west coast of the Gulf of Suez, neared completion after a 3-year construction period.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Egyptian pounds (£E) to U.S. dollars at the rate of £E1 = US$1.42.

The Mineral Industry of Finland

By Richard H. Singleton[1]

The Finnish minerals industry continued to be remarkably robust considering its very limited reserves. Its high expertise in minerals and metallurgical engineering continued to be exported in the form of equipment, plant design and construction, and consultation.

The minerals industry accounted for approximately 3% of Finland's gross domestic product (GDP). An approximate breakdown by value of the $2.5 billion[2] per year industry's production was primary metals, 80%; industrial minerals, 10%; and ore and concentrates, 10%. Steel, including stainless, accounted for about 80% of metals production, and most of the remainder was ferrochrome, copper, zinc, and nickel, in order of value. Cement comprised about one-third of the value of Finland's industrial minerals output, followed by sulfur, stone, talc, lime, and phosphate rock, in order of value. Iron ore accounted for about one-third of the value of metal concentrates production, followed by chromite, nickel, gold, zinc, and silver, in order of value. With ore reserves rapidly approaching exhaustion, metal mining was expected to come to a complete halt by the end of this century. Chromite was the exception; reserves were sufficient for well into the next century and perhaps beyond. The dwindling reserves have caused Outokumpu Oy, the major producer of all ores except iron, to look to foreign sources. It now owns the Tara Mine in Ireland, the largest lead-zinc mine in Europe, and the Viscaria Mine in Sweden, Europe's largest copper mine. The company also controls smaller copper-zinc mines in Norway. Approximately two-thirds of the feed for Outokumpu's smelters was imported during 1987.

Cobalt mining was terminated because of high production costs and low world market prices. A nickel-copper reserve mine and a zinc-copper mine were closed permanently because the ore was exhausted. Steel production continued as an economically viable industry despite a heavy debt load from modernization over past years. The industry was dependent mainly on imported iron ore. Finland's domestic iron mine, operating at a loss, was kept open primarily to support employment. Gold and silver mining increased while that of copper, iron, and nickel decreased. Imports of copper concentrate increased. Mine output of two industrial minerals, barite and pyrite, increased.

Finland became a significant world mica producer with the opening of a beneficiation plant that processed byproduct from a phosphate rock mine. Ammonia production decreased, but a new ammonia plant based on peat was under construction. A major talc deposit was being evaluated on a pilot basis.

Finland continued to be dependent on imports, mostly crude oil from the U.S.S.R., for about two-thirds of its energy supply. Total energy consumption increased by 10%. Peat production was down by about 50% because wet weather, especially in June, slowed mining. Projected significant increases in the already-high per capita energy demand, 5.9 tons of oil equivalent per capita and 90% above the average for Western Europe, resulted in construction and planned construction of a significant number of powerplants based on peat, coal, and natural gas.

Finland's economy became more robust as the real GDP increased by nearly 4% to approximately $88 billion, a significant improvement over the 1986 increase. The balance of trade remained slightly positive

although the balance of payments continued to weaken. A sharp drop in exports to the U.S.S.R. was more than offset by increased exports, especially of forest products, to Western Europe. Exports of metals, engineering equipment, and expertise decreased slightly. Import demand increased with the appreciation of the finnmark, although imports from the U.S.S.R. (about 70% mineral fuels) decreased significantly in 1987 to 14% of the total. Total Finnish exports and imports were each 22% of the GDP. U.S. exports to and imports from Finland were each about 5% of Finland's total imports and exports, respectively.

PRODUCTION

Production of concentrates of cobalt, copper, iron, and nickel decreased, mostly as a reflection of decreasing reserves of ore. Cobalt mining was terminated during the year. Gold and silver mining each increased significantly, much of it as byproducts of base metal mining. Production of cadmium increased. Selenium output partially recovered after its large drop in 1986.

Mined output of barite and pyrite each increased. The barite, most of which was exported, was a byproduct of Outokumpu's Phyasalmi copper-zinc mine. Production of ammonia decreased significantly. Oil-refinery output increased.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS					
Aluminum, secondary	13,200	17,100	21,000	22,200	22,200
Cadmium, refined	616	614	565	522	690
Chromium: Chromite:					
Gross weight:					
Lump ore thousand tons	85	312	327	r e350	338
Concentrate do	141	119	167	188	192
Foundry sand do	19	15	12	12	13
Total do	245	446	506	e550	543
Cr_2O_3 content:					
Lump ore do	24	r84	r e88	r e95	e91
Concentrate do	58	47	67	r e75	e77
Foundry sand do	9	7	r e6	r e5	e6
Total do	91	138	161	e175	e174
Cobalt:					
Mine output, Co content	r930	r860	720	627	190
Metal, refined	1,550	1,453	1,427	1,348	500
Copper:					
Mine output, Cu content	r37,861	r30,834	27,897	25,987	20,398
Metal:					
Smelter	r70,100	r77,600	68,900	84,460	80,888
Refined	55,376	57,318	58,766	64,235	e60,000
Gold troy ounces	25,206	28,067	19,130	37,680	e58,000
Iron and steel:					
Iron ore, marketable, all types:[2]					
Gross weight thousand tons	1,277	1,231	1,122	973	896
Fe content do	822	r806	738	635	588
Metal:					
Pig iron do	1,898	2,044	1,891	1,978	2,063
Ferroalloys, ferrochromium do	59	59	133	134	143
Steel, crude do	2,416	r2,632	2,518	2,586	2,669
Semimanufactures, rolled do	1,964	1,985	2,063	1,997	2,025
Lead:					
Mine output, Pb content	2,125	2,478	2,422	1,980	e2,250
Refined, secondary	6,000	e4,500	4,600	1,200	e1,200
Mercury 76-pound flasks	1,857	2,292	3,630	4,239	4,178
Molybdenum metal	218	265	326	256	262

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS —Continued					
Nickel:					
Mine output, Ni content	5,314	r6,918	8,547	11,885	10,557
Metal, electrolytic	14,837	15,282	15,656	17,791	15,392
Platinum-group metals:					
Palladium troy ounces	2,283	1,093	1,125	3,086	e3,100
Platinum do.	2,186	1,061	1,125	3,858	e3,900
Selenium kilograms	11,172	16,975	14,038	5,693	e10,000
Silver thousand troy ounces	980	1,123	998	1,193	1,415
Vanadium: Mine output, V_2O_5 content	5,694	5,469	3,805	--	--
Zinc:					
Mine output, Zn content	55,913	60,200	60,606	60,351	e55,000
Metal	155,336	158,819	160,377	155,397	151,500
INDUSTRIAL MINERALS					
Barite	3,400	8,704	8,690	6,969	11,000
Cement, hydraulic thousand tons	r1,886	1,645	1,608	1,422	1,426
Feldspar	52,066	56,265	52,940	47,049	52,000
Mica, flake	--	--	--	--	e5,000
Lime thousand tons	231	241	252	261	271
Nitrogen: N content of ammonia	67,700	68,700	65,100	66,800	50,300
Phosphate rock, apatite concentrate:					
Gross weight thousand tons	381	477	512	527	553
P_2O_5 content do.	141	176	178	185	195
Pyrite, gross weight do.	499	426	493	547	621
Sodium sulfate[e] do.	35	35	35	35	e35
Stone, crushed:					
Limestone and dolomite:					
For cement manufacture do.	2,609	2,287	2,217	1,968	e1,750
For agriculture do.	1,370	1,192	1,453	1,108	e1,050
For lime manufacture do.	344	367	357	381	e330
Fine powders do.	287	316	313	330	e290
Metallurgical do.	52	45	26	13	e12
Total do.	4,662	4,207	4,366	3,787	e3,432
Quartz silica sand do.	213	262	223	232	233
Sulfur:					
S content of pyrite do.	r211	r214	248	276	313
Byproduct:					
Of metallurgy do.	264	265	257	260	e230
Of petroleum do.	48	45	e45	42	e40
Total do.	r523	r524	550	578	e583
Sulfuric acid do.	1,149	r1,165	1,462	1,359	1,160
Talc do.	318	327	319	284	319
Titania concentrate: Ilmenite:					
Gross weight do.	164	167	53	--	--
TiO_2 content do.	74	75	24	--	--
Wollastonite	15,402	14,669	16,917	16,795	16,000
Peat:					
For fuel use thousand tons	3,355	2,713	3,140	r e3,600	e2,100
For agriculture and other uses do.	275	r246	346	r e400	e233
Petroleum refinery products thousand 42-gallon barrels	r73,600	73,500	72,500	65,300	73,400

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

[1]Table includes data available through July 22, 1988.

[2]Includes approximately 30% of unused roasted pyrite (purple ore) from the Kokkola works.

TRADE

Exports of ferrochrome increased significantly in 1986 in line with increased production. Exports of steel semimanufactures increased as exports of primary steel decreased. Exports of peat briquets increased in 1986.

Imports of copper concentrate increased significantly in 1986 as domestic output decreased somewhat. Chalk imports increased, and ammonia imports decreased, both significantly. Sulfur imports decreased in 1986, and this was partially offset by increased domestic production. Imports of electricity increased in 1987.

Table 2.—Finland: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	13	13	--	Sweden 10; Norway 2.
Metal including alloys:				
Scrap	90	40	--	West Germany 37; United Kingdom 3.
Unwrought	16,171	16,974	--	Japan 8,553; Sweden 2,624; West Germany 2,447.
Semimanufactures	19,221	9,280	97	Sweden 2,264; France 1,129; United Kingdom 1,107.
Beryllium: Metal including alloys, all forms	--	(2)	--	NA.
Chromium: Ore and concentrate	177,153	161,387	--	Sweden 153,063; Poland 6,820; Norway 365.
Cobalt: Oxides and hydroxides	535	522	10	Netherlands 365; Italy 35; Hungary 30.
Copper: Metal including alloys:				
Scrap	2,275	1,162	--	Belgium-Luxembourg 608; Sweden 422; West Germany 106.
Unwrought	18,759	22,761	17	United Kingdom 8,861; Sweden 3,935; East Germany 2,540.
Semimanufactures	44,475	51,949	2,374	West Germany 9,757; United Kingdom 9,278; Italy 6,853.
Iron and steel:				
Iron ore and concentrate, pyrite, roasted	--	1,625	--	All to Netherlands.
Metal:				
Scrap	9,646	359	--	West Germany 167; Netherlands 160; Sweden 18.
Pig iron, cast iron, related materials	2	111	--	Sweden 82; Belgium-Luxembourg 24; Norway 2.
Ferroalloys, unspecified	56,311	90,231	14,511	France 21,666; Sweden 17,898.
Steel, primary forms value, thousands	$86,675	$53,248	$2,680	West Germany $24,897; United Kingdom $6,459; Morocco $5,995.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	$72,979	$97,338	$2,820	Sweden $22,593; West Germany $21,779; United Kingdom $10,501.
Universals, plates, sheets do	$350,417	$433,914	$57,688	West Germany $64,999; Denmark $51,089.
Hoop and strip do	$20,796	$24,477	$14	West Germany $3,116; Netherlands $2,143; unspecified $14,186.
Rails and accessories	206	281	(3)	Sweden 225; Norway 50; U.S.S.R. 3.
Wire	10,325	9,268	53	Sweden 5,635; Denmark 1,814; Norway 790.
Tubes, pipes, fittings value, thousands	$67,274	$90,555	$943	Sweden $31,200; U.S.S.R. $8,516; Norway $8,048.
Castings and forgings, rough do	3,888	7,602	--	Sweden 3,588; U.S.S.R. 1,832; West Germany 597.
Lead:				
Ore and concentrate	6,105	3,927	--	All to West Germany.
Oxides	(3)	71	--	Norway 40; West Germany 22; Sweden 9.
Metal including alloys:				
Scrap	1,044	1,415	--	West Germany 1,350; Sweden 65.
Unwrought	83	227	--	Sweden 150; West Germany 72; U.S.S.R. 5.
Semimanufactures	24	24	--	Sweden 18; U.S.S.R. 6.
Magnesium: Metal including alloys, scrap	174	184	--	West Germany 142; Italy 42.
Mercury 76-pound flasks	3,132	2,349	--	Switzerland 1,015; Netherlands 609; India 493.
Molybdenum: Metal including alloys, all forms	1	--		
Nickel: Metal including alloys:				
Scrap	1,777	59	--	All to Netherlands.
Unwrought	13,852	15,086	5,144	United Kingdom 1,698; West Germany 1,561.
Semimanufactures	3	1	--	All to Sweden.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$151	$516	--	United Kingdom $234; West Germany $150; Sweden $126.

See footnotes at end of table.

Table 2.—Finland: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986: United States	Destinations, 1986: Other (principal)
METALS —Continued				
Silver:				
Waste and sweepings[3] value, thousands	$3,618	$4,165	$1,923	United Kingdom $1,147; Sweden $844.
Metal including alloys, unwrought and partly wrought ——do——	$7,517	$6,817	$274	United Kingdom $3,541; West Germany $1,216; Sweden $806.
Tin: Metal including alloys:				
Scrap	35	23	--	United Kingdom 12; West Germany 11.
Unwrought	1	--	--	
Semimanufactures	(2)	1	--	Mainly to Libya.
Titanium: Oxides—value, thousands	$4,015	$4,781	NA	NA.
Tungsten: Metal including alloys, all forms	11	12	--	West Germany 7; Belgium-Luxembourg 4.
Zinc:				
Oxides	47	9	--	U.S.S.R. 5; Nigeria 4.
Metal including alloys:				
Scrap	436	1,209	--	West Germany 715; Sweden 263; Norway 214.
Unwrought	140,364	127,756	21,505	Netherlands 23,412; United Kingdom 22,262.
Semimanufactures	68	252	(2)	U.S.S.R. 184; Norway 40; Sweden 19.
Other:				
Ores and concentrates	--	3,111	--	France 3,062; Sweden 49.
Ashes and residues	6,844	8,027	--	Sweden 4,673; East Germany 1,935; West Germany 1,344.
Base metals including alloys, all forms	1,683	1,510	282	United Kingdom 324; Netherlands 263.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Artificial: Corundum	7	--		
Grinding and polishing wheels and stones	147	131	1	U.S.S.R. 57; Poland 29; Sweden 23.
Barite and witherite value, thousands	$342	$440	--	West Germany $437; Philippines $3.
Boron materials:				
Crude natural borates	11	70	--	Denmark 50; Czechoslovakia 20.
Oxides and acids	(2)	--	--	
Cement	6,521	9,566	--	U.S.S.R. 7,772; Sweden 1,011; Norway 618.
Chalk	37	--	--	
Clays, crude	655	1,772	--	Netherlands 1,003; Sweden 740; Denmark 23.
Cryolite and chiolite	--	15	15	
Diamond:				
Gem, not set or strung value, thousands	$213	$45	--	Japan $24; Switzerland $14; Sweden $6.
Industrial stones ——do——	$2	$1	--	All to Sweden.
Diatomite and other infusorial earth	10	21	--	Venezuela 20; West Germany 1.
Feldspar, fluorspar, related materials	35,209	40,338	--	United Kingdom 23,637; West Germany 10,668; Poland 1,709.
Fertilizer materials:				
Crude, n.e.s	2,014	139	--	Bahrain 79; United Arab Emirates 60.
Manufactured:				
Ammonia	2	3	--	All to Ethiopia.
Nitrogenous	15,810	19,503	--	Switzerland 17,582; Denmark 1,806; Sweden 113.
Phosphatic	10	39	--	Sweden 19; U.S.S.R. 13; Sudan 7.
Potassic—value, thousands	$10,155	$13,852	--	Pakistan $6,221; Algeria $2,771; Cuba $2,212.
Unspecified and mixed——do——	$91,685	$72,309	$1,114	U.S.S.R. $25,425; China $14,172; Saudi Arabia $12,206.
Gypsum and plaster	--	7	--	All to U.S.S.R.
Lime	2,285	1,678	--	Sweden 890; West Germany 580; Italy 120.
Magnesium compounds	1,860	503	--	All to Sweden.
Mica:				
Crude including splittings and waste	566	274	--	West Germany 114; United Kingdom 68; Japan 56.
Worked including agglomerated splittings	(2)	--	--	
Nitrates, crude	--	20	--	All to United Kingdom.

See footnotes at end of table.

Table 2.—Finland: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Pigments, mineral: Iron oxides and hydroxides, processed	1	2	--	Vietnam 1.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$16	$37	--	Switzerland $19; Hong Kong $8; West Germany $7.
Synthetic do.	$83	$113	--	Belgium-Luxembourg $76; Sweden $33; Netherlands $2.
Pyrite, unroasted do.	$1,401	$3,700	--	West Germany $2,794; Netherlands $584; Sweden $232.
Salt and brine	135	151	--	Sweden 64; United Kingdom 52; Netherlands 16.
Sodium compounds, n.e.s.: Carbonate, manufactured	56	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	271,905	222,011	767	Italy 119,262; Spain 33,618; France 32,203.
Worked	2,812	5,305	31	West Germany 2,336; Sweden 814; U.S.S.R. 690.
Dolomite, chiefly refractory-grade	--	133	--	All to Sweden.
Gravel and crushed rock	9,689	15,551	8	Sweden 12,958; West Germany 1,980; Nigeria 30.
Limestone other than dimension	3,271	3,876	--	All to Sweden.
Quartz and quartzite	6,922	5,831	--	Netherlands 3,200; Sweden 1,653; Portugal 199.
Sand other than metal-bearing	17,774	2,756	--	U.S.S.R. 1,908; Sweden 707; Cameroon 90.
Sulfur:				
Elemental, crude including native and byproduct	--	4	--	All to Nigeria.
Sulfuric acid value, thousands	$889	$1,699	$335	Belgium-Luxembourg $689; Denmark $334.
Talc, steatite, soapstone, pyrophyllite	52,634	48,284	--	Sweden 12,044; Netherlands 8,504; United Kingdom 8,160.
Other:				
Crude	14,060	16,638	2	West Germany 8,480; Italy 2,381; France 1,583.
Slag and dross, not metal-bearing	338	1,019	--	Sweden 427; U.S.S.R. 400; West Germany 106.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2,696	1,892	--	U.S.S.R. 1,654; Sweden 238.
Carbon black	2,738	1,902	--	Ireland 1,898; Nigeria 4.
Coal:				
Anthracite and bituminous	19,209	4	--	U.S.S.R. 2.
Briquets of anthracite and bituminous coal	--	81	--	All to Norway.
Lignite including briquets	31	22	--	Do.
Coke and semicoke	13,223	9,571	--	Norway 7,170; Netherlands 2,401.
Peat including briquets and litter	55,594	92,160	--	Sweden 47,444; Netherlands 20,799; Ireland 6,874.
Petroleum:				
Crude thousand 42-gallon barrels	--	4,508	--	All to Sweden.
Refinery products:				
Gasoline do.	6,680	4,865	--	Sweden 3,691; Denmark 778; United Kingdom 228.
Mineral jelly and wax do.	(2)	2	--	Mainly to Denmark.
Kerosene and jet fuel do.	723	1,004	--	Sweden 577; Denmark 284; Singapore 144.
Distillate fuel oil do.	8,437	5,344	--	Sweden 1,900; Denmark 1,896; West Germany 884.
Lubricants do.	258	323	--	U.S.S.R. 303; Sweden 19.
Residual fuel oil do.	245	952	--	United Kingdom 444; Belgium-Luxembourg 440; Poland 38.
Bitumen and other residues do.	1	1	--	Mainly to U.S.S.R.
Bituminous mixtures do.	(2)	(2)	--	Do.
Petroleum coke do.	453	523	--	Sweden 268; Denmark 151; Belgium-Luxembourg 48.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	3,368	1,687	--	Greece 1,500; Netherlands 155; Australia 19.
Oxides and hydroxides	29,416	30,159	109	West Germany 12,975; Spain 11,400; Hungary 4,657.
Metal including alloys:				
Scrap	33,317	46,177	--	U.S.S.R. 13,502; United Kingdom 9,521; West Germany 8,169.
Unwrought	20,338	21,601	--	U.S.S.R 7,097; Spain 2,561; Brazil 2,534.
Semimanufactures	29,665	34,579	--	Sweden 7,597; West Germany 6,232; Norway 5,754.
Beryllium: Metal including alloys, all forms	(2)	(2)	(2)	
Chromium:				
Ore and concentrate	3	1	--	All from Netherlands.
Oxides and hydroxides	709	1,261	(2)	Poland 441; United Kingdom 435; West Germany 337.
Cobalt: Oxides and hydroxides	(2)	(2)	--	Mainly from Netherlands.
Columbium and tantalum: Metal including alloys, all forms, tantalum	(2)	1	(2)	Mainly from West Germany.
Copper:				
Ore and concentrate	152,619	187,820	16,650	Sweden 48,979; Norway 42,046; Bulgaria 23,024.
Matte and speiss including cement copper	1	(2)	--	All from West Germany.
Metal including alloys:				
Scrap	438	114	41	United Kingdom 27; Italy 23.
Unwrought	22,357	16,596	--	U.S.S.R. 10,051; Zaire 3,598; Zambia 2,001.
Semimanufactures	19,017	23,656	42	West Germany 9,337; Sweden 5,763; United Kingdom 3,554.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite -- thousand tons	1,756	1,987	--	Sweden 1,225; U.S.S.R. 643; Norway 119.
Metal:				
Scrap	113,350	63,339	--	U.S.S.R. 50,041; United Kingdom 13,221; Sweden 46.
Pig iron, cast iron, related materials	20,174	18,621	1	West Germany 5,731; Canada 4,990; United Kingdom 3,483.
Ferroalloys:				
Ferromanganese	4,294	4,496	--	Norway 2,321; West Germany 1,150; France 1,005.
Unspecified	49,620	39,588	37	U.S.S.R. 10,899; Norway 9,752; Greece 5,769.
Steel, primary forms	46,601	19,103	--	West Germany 14,018; Netherlands 3,422; Sweden 776.
Semimanufactures:				
Bars, rods, angles, shapes, sections	231,002	260,058	8	Sweden 59,356; West Germany 35,890; France 29,989.
Universals, plates, sheets	232,566	225,111	1	Sweden 42,555; West Germany 32,184; United Kingdom 26,461.
Hoop and strip	30,304	30,602	4	Sweden 13,341; West Germany 7,351; Belgium-Luxembourg 3,071.
Rails and accessories	2,542	3,076	(2)	West Germany 1,501; Austria 725; Belgium-Luxembourg 520.
Wire	23,352	21,332	106	Sweden 7,140; Belgium-Luxembourg 3,901; West Germany 3,076.
Tubes, pipes, fittings	130,173	122,590	46	West Germany 32,238; United Kingdom 17,628; Czechoslovakia 15,716.
Castings and forgings, rough	4,118	4,740	(2)	West Germany 1,326; Sweden 888; United Kingdom 627.
Lead:				
Ore and concentrate	91	--	--	
Oxides	174	450	6	West Germany 397; East Germany 35; Denmark 7.
Metal including alloys:				
Scrap	--	10	--	All from Sweden.
Unwrought	19,578	15,771	--	Sweden 7,177; U.S.S.R. 6,515; United Kingdom 1,298.
Semimanufactures	823	800	(2)	Sweden 362; West Germany 324; Belgium-Luxembourg 108.
Magnesium: Metal including alloys:				
Scrap	3	--	--	
Unwrought	87	149	--	Norway 82; Netherlands 23; Greece 21.
Semimanufactures	906	884	(2)	Norway 853; Italy 22; West Germany 5.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Manganese:				
Ore and concentrate, metallurgical-grade	10,045	2,265	--	Morocco 1,200; Netherlands 1,045; Norway 20.
Oxides	744	425	--	Netherlands 198; Belgium-Luxembourg 166; Brazil 60.
Mercury 76-pound flasks	29	(2)	--	Mainly from West Germany.
Molybdenum: Metal including alloys, all forms	6	2	(2)	Austria 1.
Nickel:				
Ore and concentrate	13,661	10,971	19	Norway 10,945; China 6.
Matte and speiss	9,759	9,267	--	Australia 6,663; Canada 2,604.
Metal including alloys:				
Scrap	2,618	3,839	--	Netherlands 3,803; Canada 36.
Unwrought	5,083	2,735	170	Canada 2,025; U.S.S.R. 512.
Semimanufactures	76	87	14	West Germany 30; United Kingdom 17.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$603	$1,915	$15	United Kingdom $1,622; Sweden $127; Switzerland $86.
Silver:				
Waste and sweepings[3] do	$125	$37	--	Sweden $22; West Germany $15.
Metal including alloys, unwrought and partly wrought do	$5,330	$6,232	$11	Sweden $3,416; West Germany $897; France $745.
Tin: Metal including alloys:				
Unwrought	112	214	--	Brazil 92; West Germany 35; Netherlands 31.
Semimanufactures	114	186	(2)	United Kingdom 127; West Germany 43; Belgium-Luxembourg 8.
Titanium: Oxides	926	545	200	West Germany 285; United Kingdom 41.
Tungsten: Metal including alloys, all forms	18	23	16	Portugal 3; West Germany 2.
Uranium and/or thorium: Metal including alloys, all forms value, thousands	$2	$4	--	West Germany $3; United Kingdom $1.
Zinc:				
Ore and concentrate	183,143	189,686	--	Sweden 70,506; Canada 62,588; Greenland 21,805.
Oxides	359	297	--	West Germany 204; Spain 42; United Kingdom 31.
Metal including alloys:				
Scrap	80	77	--	All from United Kingdom.
Unwrought	104	79	--	Norway 41; Netherlands 36; U.S.S.R. 2.
Semimanufactures	739	18	1	Norway 424; West Germany 55; Belgium-Luxembourg 39.
Other:				
Ores and concentrates value, thousands	$8,192	$12,299	$694	Norway $7,746; Australia $3,097.
Ashes and residues	14,921	2,365	594	Netherlands 735; Australia 506.
Base metals including alloys, all forms value, thousands	$6,626	$6,612	$756	Zaire $2,680; West Germany $924.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	14,712	490	--	Greece 384; Sweden 38; United Kingdom 8.
Artificial: Corundum	1,110	1,543	4	Austria 683; United Kingdom 264; West Germany 169.
Dust and powder of precious and semi-precious stones including diamond value, thousands	$14	$19	--	Sweden $5; Ireland $4; Japan $4.
Grinding and polishing wheels and stones	2,411	2,378	16	West Germany 625; Austria 544; Sweden 176.
Asbestos, crude	2,479	2,165	--	Canada 1,622; Zimbabwe 210; U.S.S.R. 134.
Barite and witherite	1,721	1,769	--	West Germany 1,124; United Kingdom 390; China 216.
Boron materials:				
Crude natural borates	15,098	13,929	129	Turkey 13,800.
Oxides and acids	1,038	1,204	29	Turkey 712; Italy 351; France 44.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Cement	33,207	49,959	(2)	East Germany 16,335; U.S.S.R. 8,854; Denmark 8,607.
Chalk	119,702	162,420	3	Denmark 110,937; West Germany 38,344; United Kingdom 8,073.
Clays, crude	614,565	669,429	23,449	United Kingdom 591,971; West Germany 17,771.
Cryolite and chiolite	28	40	--	All from Denmark.
Diamond:				
Gem, not set or strung value, thousands	$3,946	$4,559	--	Belgium-Luxembourg $2,513; Israel $752; Switzerland $643.
Industrial stones do.	$86	$193	$8	West Germany $75; Belgium-Luxembourg $69; Switzerland $33.
Diatomite and other infusorial earth	4,739	5,506	621	Norway 2,520; United Kingdom 666; Denmark 644.
Feldspar, fluorspar, related materials	8,665	6,422	--	Mexico 6,088; Sweden 236; United Kingdom 98.
Fertilizer materials:				
Crude, n.e.s	54	47	--	All from United Kingdom.
Manufactured:				
Ammonia	351,932	252,051	32,060	U.S.S.R. 193,702; Netherlands 16,011.
Nitrogenous	27,968	52,576	(2)	Netherlands 19,749; Norway 13,118; U.S.S.R. 8,837.
Phosphatic	20	4	--	China 3.
Potassic value, thousands	$38,187	$38,478	$2	U.S.S.R. $13,628; East Germany $11,808; West Germany $6,242.
Unspecified and mixed	50,260	27,369	(2)	Romania 11,001; Hungary 10,028; Netherlands 4,246.
Graphite, natural	84	82	--	Sweden 75; West Germany 4; United Kingdom 2.
Gypsum and plaster	169,031	185,773	34	Spain 134,425; East Germany 30,634; U.S.S.R. 13,695.
Lime	7,540	7,467	--	Denmark 5,776; Sweden 1,625; Switzerland 40.
Magnesium compounds	17,631	9,620	7	China 6,455; Spain 2,350; Austria 380.
Mica:				
Crude including splittings and waste	248	276	--	United Kingdom 216; Norway 34; West Germany 20.
Worked including agglomerated splittings	30	38	--	Switzerland 19; Austria 7; Sweden 4.
Nitrates, crude	190	69	--	Chile 40; Poland 20; France 5.
Phosphates, crude value, thousands	$16,014	$9,044	$4,961	Morocco $2,346; Algeria $1,722.
Pigments, mineral: Iron oxides and hydroxides, processed	3,206	2,338	27	Belgium-Luxembourg 1,884; United Kingdom 377.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$246	$399	--	West Germany $160; Switzerland $85; Thailand $71.
Synthetic do.	$814	$814	$591	Switzerland $81; Austria $55.
Pyrite, unroasted	13	8	--	West Germany 7.
Salt and brine	598,805	526,692	5	Netherlands 190,255; Poland 142,382; West Germany 67,040.
Sodium compounds, n.e.s.: Carbonate, manufactured	58,450	52,643	--	Poland 21,617; U.S.S.R. 13,610; East Germany 9,754.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	1,735	2,011	--	Norway 1,458; Italy 187; Sweden 161.
Worked	2,474	3,238	--	Italy 1,458; Sweden 644; France 518.
Dolomite, chiefly refractory-grade	14,421	10,458	--	West Germany 4,234; Belgium-Luxembourg 3,050; Sweden 2,051.
Gravel and crushed rock	18,513	19,610	6	Sweden 14,756; Norway 3,192; West Germany 1,250.
Limestone other than dimension	738,516	755,261	25	Sweden 752,375; Denmark 1,711; United Kingdom 1,022.
Quartz and quartzite	158	200	52	West Germany 55; Netherlands 50.
Sand other than metal-bearing	61,508	48,400	--	Belgium-Luxembourg 31,111; Denmark 12,986; Sweden 3,335.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur:				
Elemental:				
Crude including native and by-product	78,377	28,183	--	West Germany 15,106; Poland 11,885; Sweden 1,187.
Colloidal, precipitated, sublimed	514	13	--	West Germany 12.
Sulfuric acid	22,156	340	--	U.S.S.R. 267; West Germany 40; Netherlands 32.
Talc, steatite, soapstone, pyrophyllite	577	424	--	Belgium-Luxembourg 276; Norway 61; West Germany 26.
Other:				
Crude	65,127	67,839	29	Norway 51,126; Sweden 15,217; U.S.S.R. 718.
Slag and dross, not metal-bearing	37,652	49,617	--	East Germany 26,494; Sweden 21,523; Norway 1,505.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	687	355	31	Trinidad and Tobago 318; United Kingdom 6.
Carbon black	9,934	10,157	102	Netherlands 3,958; Sweden 3,360; West Germany 2,156.
Coal:				
Anthracite and bituminous thousand tons	5,089	5,454	396	Poland 2,460; U.S.S.R. 1,551; Colombia 609.
Lignite including briquets do.	7	6	--	All from East Germany.
Coke and semicoke do.	1,231	1,109	--	U.S.S.R. 718; United Kingdom 143; Sweden 125.
Peat including briquets and litter	274	63	--	Burundi 33; U.S.S.R. 14; Sweden 12.
Petroleum:				
Crude thousand 42-gallon barrels	71,743	73,013	--	U.S.S.R. 62,566; Saudi Arabia 6,935; United Kingdom 1,319.
Refinery products:				
Liquefied petroleum gas[4] value, thousands	$760,619	$125,020	--	U.S.S.R. $124,884; Italy $64; Netherlands $62.
Gasoline thousand 42-gallon barrels	253	418	(2)	Sweden 259; Netherlands 128; Belgium-Luxembourg 17.
Mineral jelly and wax do.	106	88	(2)	West Germany 56; Hungary 14; China 6.
Kerosene and jet fuel do.	130	182	--	Spain 144; U.S.S.R. 31; Netherlands 5.
Distillate fuel oil do.	8,387	10,584	--	U.S.S.R. 10,582.
Lubricants do.	1,128	934	7	Italy 153; United Kingdom 150; Netherlands 144.
Residual fuel oil do.	11,325	13,870	--	All from U.S.S.R.
Bitumen and other residues do.	286	316	--	Sweden 158; Netherlands 105; Denmark 46.
Bituminous mixtures do.	33	7	2	Belgium-Luxembourg 2; Sweden 1.
Petroleum coke do.	238	306	302	United Kingdom 2; West Germany 1.

[1]Table prepared by Josef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.
[4]May include natural gas.

COMMODITY REVIEW

METALS

Cobalt.—Outokumpu ceased mining cobalt ore in May. Cobalt reserves at its Keretti Mine were nearing exhaustion and the operation had become unprofitable. Meanwhile, the company also terminated production of standard grades of cobalt metal, including standard grades of cobalt powder, at its Kokkola smelter. Outokumpu revealed that it would continue to produce cobalt salts and premium-quality superfine powders at its Kokkola works using concentrate from the Greenvale Mine in Queensland, Australia, on the basis of a 6-year contract signed in the fall of 1986. The company estimated that annual future production would be 1,100 tons of cobalt in salts and 400 tons of superfine metal powder. Production by Outokumpu of cobalt in salts increased by 41% in 1987 to 760 tons.

Copper.—Mined copper, nearly all produced by Outokumpu, decreased for the fourth consecutive year, mainly because of shrinking ore reserves. Production had decreased by nearly 50% since 1983, and most of the country's copper concentrate demand was met by imports. Two copper mines were closed permanently. In July, Outokumpu closed the Hammaslahti Mine, which produced about 3,000 tons per year of copper in concentrate as a coproduct with zinc concentrate; in April, the company closed the Kotalahti Mine, which produced about 500 tons of per year of copper in concentrate as a byproduct of nickel mining. The large Keretti Mine, which produced nearly one-half of Finland's copper concentrate, also was closed in April, but it resumed production in July with Government subsidies, primarily to avoid unemployment. Outokumpu actively sought additional foreign sources of copper feed material to support its domestic copper metal industry. It procured part ownership in two Norwegian mines, the Folldal Verk Mine and the Grong Gruber Mine, each of which produced annually about 25,000 tons of copper in concentrate as well as zinc concentrate. The venture, Norsulfid A/S, was owned jointly on a 50-50 basis with Orkla-Borregard A/S, a Norwegian firm. Most of the copper concentrate was destined for Outokumpu's Harjavalta smelter in Finland. Development of this new feed source was offset by closure in 1987 of the Lokken Mine in Norway, which had been a source of feed material for Outokumpu.

Four of Outokumpu's copper mines remained in operation in Finland at yearend. In addition, a minor quantity of byproduct copper concentrate was produced by Rautaruukki Oy at its Rautavaara iron mine.

The Harjavalta smelter was closed for 2 months during the summer for installation of a new $23 million flash-smelting furnace that increased smelting capacity by 25% to 100,000 tons of copper per year. The new process was claimed to increase metal yields from copper and nickel ores. The product copper anodes were subsequently refined electrolytically at the Pori works. About 11,000 tons of anode production was lost during the shutdown, and refinery production was reduced during that time by about 50%. However, smooth operation resumed in the fall at both facilities.

Iron and Steel.—Rautaruukki Oy, the large Government-owned steel company with more than 80% of Finland's steel production, signed an agreement early in the year with Ovako Steel Oy Ab, a Finnish specialty steel manufacturer, giving Rautaruukki control of all of Finland's production of ordinary steel. The agreement became effective on June 1. Ovako transferred its Koverhar 450,000-ton-per-year steel-rolling billet works and three steel semimanufacturing mills to Dalsbruk Oy, a new Rautaruukki division in which Ovako held a 20% share. Rautaruukki was studying a plan to construct a new billet caster at its large 2-million-ton-per-year Raahe crude steelworks to take full advantage of the plant's smelting capacity. The company indicated that this could affect the future of the Koverhar mill.

Rautaruukki completed construction of a new coke plant on schedule in October. The plant was designed to supply two-thirds of the coke requirements of the Raahe works.

Outokumpu finished construction of a new $125 million hot-rolling mill at its Tornio works, making it a vertically integrated producer of stainless steel semifabricated products, beginning with its chromite and nickel mines. Rolling mill trial runs began before yearend.

Nickel.—Outokumpu's Kotalahti nickel mine closed in April because of ore exhaustion after 27 years of operation. The mine produced about 1,700 tons of nickel in concentrate during 1986. Restart of the Hitura nickel mine was postponed; excavation was

halted with no final decision on whether the operation might resume later. The mine had been idled in 1985 because of low nickel prices and limited reserves, sufficient for 1.5 years. Outokumpu continued operation of its two other nickel mines, and the firm's total production decreased by 12% to about 9,900 tons of nickel in concentrate during 1987. Approximately 75% of this production was from the new Enonkoski Mine, and the balance was from the Vammala Mine. Myllykoski Oy also produced a minor amount of nickel concentrate as a byproduct from its talc beneficiation mill at Luikonlahti, Kuopio.

INDUSTRIAL MINERALS

Mica.—Kemira Oy, Finland's large state-owned fertilizer and chemicals company, began production of phlogopite flake as a byproduct of its phosphate rock mine at Siilinjarva in central Finland. The mica beneficiation and comminution plant had been constructed in 1985, started up in 1986, and came on-stream in early 1987 with an annual capacity of 16,000 tons. Wet ground flake was available in nominal sizes ranging from 40 to 900 micrometers for use as fillers, pigments, and plastic reinforcements. Total 1987 sales, mostly to Western European and Japanese markets, was about 2,000 tons.

Nitrogen.—A 90,000-ton-per-year ammonia plant was under construction by Kemira at Oulu, a port on the northern part of the Gulf of Bothnia. An old ammonia plant based on naphtha that had been closed in 1979 was being converted to a plant based on peat as raw material. Completion, scheduled for 1989, was expected to increase domestic production sufficiently to supply nearly 50% of domestic consumption. The plant was designed to consume approximately 240,000 tons of peat per year. Meanwhile, Finland was dependent on exports for about three-quarters of its ammonia supply.

Phosphate Rock.—Kemira confirmed its tentative plan to open in 1992 its new Sokli phosphate rock mine and beneficiation plant in the Finnish Lapland about 60 miles north of the Arctic Circle, at an estimated cost of $275 million. The concentrate was to be pipelined 225 miles to Finland's west coast port of Kemi. Most would be exported to Kemira's fertilizer plants in Belgium and Denmark. The Sokli complex was expected to produce about 2 million tons of concentrate per year, and estimated reserves appeared to be sufficient for about 20 years of production. The ore body is reportedly one of the world's largest carbonatite deposits and its apatite is free of cadmium, which had been an environmental problem in Western Europe. Construction was expected to begin in 1989 after issuance of a mining permit and after completion of additional feasibility studies based on economic and political factors. The company had not applied for the permit by yearend.

Sulfur.—Output of pyrite concentrate increased at Outokumpu's Pyhasalmi Mine, Finland's only remaining domestic source of pyrite, as a result of temporary mining of a pocket of ore particularly high in pyrite content. Revised data on proven reserves showed that there was enough for at least 20 years of mining.

Byproduct sulfur from metallurgical operations came principally from the smelting of zinc and copper concentrates, in order of volume. About two-thirds of these concentrates was imported. Until 1987, lesser amounts of sulfur, about 40,000 tons per year, were derived from the smelting at Kokkola of cobalt-bearing pyrites. This source of sulfur was discontinued in May.

Sulfuric acid demand for fertilizer manufacture, a major use, decreased. Outokumpu acquired full ownership from Kemira of the acid plants at its Harjavalta copper smelter, but Kemira retained ownership of the acid plant at Outokumpu's zinc smelter at Kokkola. Outokumpu sold most of the SO_2 gases from the zinc smelter to Kemira. Kemira converted some of the gases to acid on a toll basis for Outokumpu, which marketed the acid.

Talc.—A major talc deposit in northern Finland was being evaluated on a pilot basis by Myllykoski Oy, Finland's only private mining company. Myllykoski was the largest talc miner in Finland, producing about two-thirds of the country's beneficiated product, which contained about 97% talc. Domestic talc production was used mainly in the Finnish paper industry, as a substitute for imported kaolin.

MINERAL FUELS

Total consumption of mineral fuels increased by approximately 10% because of cold weather and growth in industry and transportation. Oil and gas imports, both primarily from the U.S.S.R., increased by about 10% and 40%, respectively. Hydro-

power output increased by about 10% while nuclear power and peat-generated power were stable. Finland remained about 65% dependent on imports for its energy supply; of this, 65% was oil, nearly all for use in transportation, followed by coal, 15%; natural gas, 10%; and electrical power, 10%. The domestically produced energy supply source breakdown was nuclear, 50%; hydro, 35%; and peat plus wood waste, 15%.

Finland's consumption of electrical power was among the highest per unit of the GDP in Europe, and demand was increasing. The fuel-source breakdown for electrical power production was nuclear, 32%; hydro, 24%; coal, 12%; peat and wood waste, 11%; electrical power imports, 11%; gas, 6%; and oil, 4%. Negotiations continued with the U.S.S.R., Sweden, and Norway regarding further importation of electrical energy. An agreement was signed with Sweden for construction of a 120-mile-long submarine cable across the lower part of the Gulf of Bothnia to Rauma in Finland. Design capacity was 400 megawatts (MW) of direct-current electrical power. Both Swedish and Norwegian power was to be delivered to Finland beginning in 1989. The newly elected Government approved in May a 10-year General Energy Plan that included construction of 1,100 MW of electrical powerplants burning peat, wood waste, coal, and gas at a projected total cost of about $1 billion. Preparations were being made to import 600 MW of power, generated by burning natural gas, from Norway beginning in 1993. Imports of natural gas from the U.S.S.R. were expected to increase. Negotiations regarding importation of gas from Norway via Sweden were begun but no definitive pipeline or gas delivery contracts were in sight.

Nuclear Power.—Four nuclear reactors were operating in Finland, two of Soviet and two of Swedish design, with a total electrical generation capacity of 2,300 MW. The Government had no plans to dismantle these plants, although construction of a fifth plant was canceled after the Chernobyl incident. Construction of future plants was postponed.

Peat.—Production of peat was down to about 50% of that planned because of a very wet summer. Sufficient stocks of fuel peat remained, because of high output in 1986, to last through the 1987-88 winter. A 150-MW peat-burning electrical powerplant was being built at Haakevesi at a cost of $160 million. A similar 120-MW plant at Seinaejoki was planned at a cost of $140 million. Peat-fired powerplants were near peat-mining sites to save transportation costs. Plant design usually included use of by-product thermal energy for district heating.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from finnmarks (Fmk) to U.S. dollars at the rate of Fmk4.4 = US$1.00.

The Mineral Industry of France

By John G. Panulas[1]

Mining and mining product activities amounted to about 5% of France's 1987 gross national product of $880 billion,[2] about the same as that of 1986. The decline in output that characterized the industry the previous year had slowed. French alumina, arsenic, bromine, cadmium, diatomite, feldspar, ferroalloys, fluorspar, gypsum, magnesium metal, potash, talc, and zinc metal continued to make up a significant portion of supply to the world market.

Government Policies and Programs.—The French Government placed emphasis on the use of depletion allowances for research and development expenditures in the mining sector. The allowances were neither to exceed 15% of product sales included in taxable income within France, where the product was extracted from French mineral deposits, nor to exceed 50% of the net taxable income itself from sales of the same product, processed or unprocessed. Moreover, the allowances were permitted only if the originating ores were mined in France and if the allowances were reinvested within 5 years in fixed assets, research expenditure, or research company equity shares. By a decree of the Minister of Economy and Finance, the allowances were to apply to the following mineral commodities: aluminum, andalusite, antimony, arsenic, asbestos, barite, beryllium, bismuth, boron, chromium, cobalt, columbium-tantalite, copper, fluorine, gold, kaolin, lead, lithium, manganese, mica, molybdenum, nickel, phosphates, platinum, potassium, pyrites, radioactive minerals, rare earths, refractory products, silica, silver, sulfur, talc, tin, titanium, tungsten, vanadium, zinc, and zirconium.

In addition, the French Government offered a 50% tax reduction (up to 5 million francs per firm) on the following types of research and development expenditures applicable to the mining industry: the construction cost of buildings used solely for scientific and technical research, including prototypes and pilot installations; the cost of equity shares in Government-approved research companies and organizations; the payroll costs for research; other operating expenses related to research and development activities up to a limit of 55% of the aforementioned payroll costs; and expenses associated with obtaining and maintaining patents.

PRODUCTION

The French Government held the preponderant financial interests in most of the mining, metallurgical, and energy companies in France. These included Bureau de Recherches Géologiques et Minières (BRGM) and its subsidiary, Cie. Française des Mines S.A., as well as Charbonnages de France (CdF), Cie. Générale des Matières Nucléaires, Imetal S.A., Pechiney, Société des Aciéries et Laminoirs de Lorraine (Sacilor), Société Nationale Elf Aquitaine (Elf), and Union Sidérurgique du Nord et de l'Est de la France S.A. (Usinor).

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987[p]
METALS					
Aluminum:					
Bauxite, gross weight ----- thousand tons	1,663	1,607	1,530	1,379	1,272
Alumina:					
Crude ----- do	r858	r898	734	884	866
Calcined ----- do	r702	r750	624	740	712
Metal:					
Primary ----- do	361	342	293	322	323
Secondary ----- do	170	169	170	173	196
Antimony:					
Mine output, Sb content -----	111	--	--	--	--
Metal, including regulus -----	6,487	7,036	7,333	6,822	7,100
Arsenic, white -----	4,727	3,828	e8,000	e10,000	e10,000
Cadmium metal -----	513	568	337	431	400
Cobalt metal including powder -----	131	116	123	e100	110
Copper:					
Mine output, Cu content -----	114	79	253	294	300
Metal:					
Blister, secondary -----	7,210	6,796	7,000	6,100	6,000
Refined:					
Primary[e] -----	r23,000	r20,931	r23,500	18,294	20,000
Secondary -----	r22,063	r20,000	20,200	e23,000	e19,000
Total -----	45,063	40,931	43,699	41,294	e39,000
Gold, mine output, Au content ---troy ounces	71,659	70,279	90,021	75,618	e64,000
Iron and steel:					
Iron ore and concentrate:					
Gross weight ----- thousand tons	15,930	14,839	14,681	12,436	10,852
Fe content ----- do	5,061	4,680	4,700	3,861	3,255
Metal:					
Pig iron ----- do	13,856	15,039	15,426	13,708	13,267
Ferroalloys:					
Blast furnace: Spiegeleisen and ferro-manganese ----- do	r276	329	331	274	e200
Electric-furnace:					
Ferrochrome ----- do	20	19	e20	e1	1
Ferromanganese ----- do	33	35	e35	22	15
Ferrosilicon ----- do	r193	r205	e205	196	190
Silicon metal ----- do	65	71	e70	e75	70
Other ----- do	103	119	e120	77	70
Total ----- do	r690	r778	781	e645	e546
Steel ingots and castings ----- do	17,623	19,008	18,569	17,624	17,726
Semimanufactures ----- do	15,348	16,543	17,234	15,343	e15,000
Lead:					
Mine output, Pb content -----	1,512	2,263	1,600	2,478	2,213
Smelter:					
Primary -----	114,948	117,900	133,600	e140,000	e135,000
Secondary -----	13,600	13,500	12,200	e12,500	e12,000
Total -----	128,548	131,400	145,800	e152,500	e147,000
Refined:					
Primary: Soft lead -----	114,948	117,900	133,600	132,000	138,795
Secondary:					
Soft lead -----	37,464	24,900	25,525	27,300	32,700
Lead content of antimonial lead ----	62,000	62,900	63,000	71,100	74,370
Total -----	214,412	205,700	223,637	230,400	245,865
Magnesium metal including secondary -----	11,075	r12,972	13,800	13,376	13,600
Nickel, metal -----	7,300	5,217	7,020	8,241	6,680
Silver: Mine output, Ag content:					
Lead and zinc concentrates thousand troy ounces	552	634	691	677	680
Mixed copper, gold, silver concentrates do	136	156	158	155	150
Total ----- do	688	790	849	832	830
Metal, Ag content of final smelter products do	28,903	25,540	25,856	e26,000	24,200
Tin, smelter output of solder and other alloys, secondary -----	6,708	6,700	3,074	2,912	2,532
Tungsten concentrate, W content -----	832	796	735	982	--

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987[p]
METALS —Continued					
Uranium:					
Mine output, U content	3,890	3,116	3,752	3,737	3,321
Chemical concentrate, U_3O_8 equivalent	3,299	3,676	3,940	4,106	3,740
Zinc:					
Mine output, Zn content	34,272	36,231	40,572	39,534	31,339
Metal including secondary:					
Slab	249,500	258,514	285,600	289,500	249,340
Dust	9,300	7,400	8,200	e8,000	e9,000
INDUSTRIAL MINERALS					
Barite	152,600	148,200	120,800	116,400	104,050
Bromine, elemental[e]	16,000	17,500	20,000	19,000	20,000
Cement, hydraulic thousand tons	24,504	22,724	22,219	22,596	23,560
Clays:					
Bentonite[3]	3,091	3,475	14,900	e10,000	e10,000
Kaolin and kaolinitic clay (marketable) thousand tons	289	307	1,510	1,350	e1,400
Refractory clay, unspecified do.	413	458	486	e500	e500
Diatomite do.	221	247	270	269	e270
Feldspar, crude do.	e175	209	172	216	274
Fluorspar:					
Crude do.	396	504	562	497	374
Marketable:					
Acid- and ceramic-grade do.	141	159	160	148	134
Metallurgical-grade do.	55	73	64	50	e50
Total do.	196	232	224	198	184
Gypsum and anhydrite, crude do.	5,557	5,401	5,286	5,259	4,508
Kyanite, andalusite, related materials do.	43	52	57	51	50
Lime: Quicklime, hydrated lime, dead-burned dolomite do.	2,946	3,130	3,100	2,900	e3,000
Mica	9,286	10,854	10,084	10,834	e11,000
Nitrogen: N content of ammonia thousand tons	1,960	2,350	2,010	e2,000	e2,100
Pigments, mineral, natural: Iron oxides[e]	16,000	15,000	14,500	15,000	15,000
Phosphates: Thomas slag thousand tons	1,124	1,194	1,165	855	768
Potash:					
Gross weight (run-of-mine) do.	10,874	12,480	12,021	11,600	10,716
K_2O equivalent (run-of-mine) do.	1,651	1,873	1,882	1,748	1,500
K_2O equivalent (marketable) do.	1,537	1,739	1,750	1,620	1,485
Pozzolan and lapilli do.	607	500	496	410	420
Salt:					
Rock salt do.	282	226	369	386	1,476
Brine salt (refined) do.	1,074	1,125	1,154	1,125	1,070
Marine salt do.	1,354	1,381	1,423	1,610	1,627
Salt in solution do.	4,239	4,417	4,167	3,963	3,663
Total do.	6,949	7,149	7,113	7,084	7,836
Sodium compounds:[e]					
Sodium sulfate do.	150	120	125	110	120
Sodium carbonate do.	1,000	900	900	750	780
Stone, sand and gravel:					
Limestone, agricultural and industrial do.	6,625	e6,700	7,002	e6,000	e6,000
Slate, roof do.	52	64	60	57	60
Sand and gravel:					
Industrial sand, total do.	5,558	5,395	5,512	5,332	7,472
Other sand and gravel, alluvial do.	199,000	181,000	178,300	186,800	e193,000
Sulfur, byproduct:					
Of natural gas do.	1,653	1,589	1,400	957	1,092
Of petroleum do.	157	163	161	193	188
Of unspecified sources[e] do.	100	110	162	156	150
Total do.	1,910	1,862	1,723	1,306	1,430
Talc:					
Crude	315,800	320,300	316,595	324,660	269,000
Powder	286,500	292,406	310,897	314,965	e300,000
MINERAL FUELS AND RELATED MATERIALS					
Asphaltic material	47,000	44,500	40,942	37,817	e40,000
Carbon black	218,600	165,900	e200,000	e175,000	e180,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Coal including briquets:					
Anthracite and bituminous coal thousand tons	17,021	16,594	15,124	14,394	[e]15,000
Lignite do	2,591	2,426	1,839	2,142	[e]2,200
Total do	19,612	19,020	16,963	16,536	[e]17,200
Briquets do	1,512	1,450	1,408	1,176	1,200
Coke, metallurgical do	8,458	8,999	8,691	8,258	7,470
Gas, natural:					
Gross million cubic feet	234,313	224,601	275,753	210,619	[e]250,000
Marketed do	221,953	213,124	191,359	148,932	[e]150,000
Natural gas liquids thousand 42-gallon barrels	7,480	7,424	6,840	[e]7,000	[e]7,000
Peat[e] thousand tons	110	228	191	220	[e]200
Petroleum:					
Crude thousand 42-gallon barrels	12,093	15,040	19,252	21,482	22,638
Refinery products:					
Liquefied petroleum gas do	28,037	27,863	30,334	27,326	[e]28,000
Gasoline, all kinds do	136,777	138,782	141,950	140,637	[e]140,000
Jet fuel do	35,797	35,488	34,176	33,886	[e]34,000
Kerosene do	1,434	388	481	376	[e]400
Distillate fuel oil do	181,802	218,302	217,989	214,165	[e]215,000
Heavy fuel oil do	115,983	103,889	89,636	85,227	[e]86,200
Other products do	23,804	5,119	53,164	51,189	[e]51,000
Refinery fuel and losses do	40,020	39,744	35,261	30,935	[e]31,000
Total do	563,654	569,575	602,991	583,741	[e]585,600

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

[1]Table includes data available through Sept. 23, 1988.

[2]In addition to the commodities listed, France also produces germanium from domestic ores and has been described as the world's leading producer of this commodity in French sources. Output was reported as being all from the Saint-Salvy Mine. Unfortunately, actual output is not regularly reported, and the ore from this mine is not sufficiently uniform in grade to permit estimates of output based on reported concentrate production. In addition, France produces large quantities of stone, but statistics on output are not available.

[3]Includes smectic clay.

TRADE

Although France continued to rely heavily on foreign sources for its nonfuel and fuel minerals, its dependence on foreign vendors for coal diminished significantly, because 70% of the country's electricity was generated from nuclear energy. The United States continued as France's most important supplier of coal. Contracts with the Republic of South Africa were terminated, reflecting a shift toward Australia as a second major source of coal.

Available information indicates that, on balance, France posted a trade deficit of $14.4 billion, of which 69% was incurred in trade with partners in the European Economic Community (EEC). Nonenergy mineral commodities accounted for $1 billion of the deficit. Of this, 75% consisted of metalliferous ores and scrap. Foreign trade in nonferrous metals and iron and steel products incurred net losses of $208 million and $510 million, respectively, but surpluses of $174 million and $234 million occurred from trade with other EEC nations. Likewise, commerce in crude industrial minerals with EEC countries produced a gain of $42 million against a deficit of $248 million with the world as a whole.

Table 2.—France: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	3,191	36	(2)	West Germany 20; Netherlands 5; Italy 5.
Alkaline-earth metals	3,017	915	86	West Germany 204; Yugoslavia 145; Belgium-Luxembourg 138.
Aluminum:				
Ore and concentrate	200,733	116,060	(2)	West Germany 105,934; Sweden 5,831; Spain 309.
Oxides and hydroxides	300,111	194,329	4,048	Italy 60,911; Austria 60,011; Norway 14,588.
Ash and residue containing aluminum	27,855	18,575	--	Italy 11,053; West Germany 3,551; Belgium-Luxembourg 1,801.
Metal including alloys:				
Scrap	90,939	99,521	--	Italy 43,134; West Germany 24,950; Belgium-Luxembourg 18,631.
Unwrought	115,371	143,274	1,201	West Germany 54,281; Italy 31,811; Belgium-Luxembourg 18,225.
Semimanufactures	283,043	286,259	32,444	West Germany 74,800; United Kingdom 37,701.
Antimony:				
Ore and concentrate	209	19	--	Spain 16.
Oxides	5,359	4,630	768	West Germany 1,098; United Kingdom 654.
Metal including alloys, all forms	126	91	(2)	West Germany 52; Italy 11; Spain 10.
Arsenic: Oxides and acids	10,289	43	--	Denmark 20; Chile 10; Italy 6.
Beryllium:				
Oxides and hydroxides	(2)	--		
Metal including alloys, all forms	(2)	(2)	--	All to Switzerland.
Bismuth: Metal including alloys, all forms	11	1	--	Mainly to Algeria.
Cadmium: Metal including alloys, all forms	275	412	33	Belgium-Luxembourg 159; Italy 110; West Germany 46.
Cesium and rubidium: Metal including alloys, all forms	(2)	(2)	--	Mainly to Netherlands.
Chromium:				
Ore and concentrate	3,124	951	--	Italy 719; Spain 94; Israel 36.
Oxides and hydroxides	384	287	--	Belgium-Luxembourg 151; Italy 41; West Germany 21.
Metal including alloys, all forms	1,615	1,797	326	Netherlands 607; West Germany 326.
Cobalt:				
Ore and concentrate	2	57	--	Norway 46; United Kingdom 10; Netherlands 1.
Oxides and hydroxides	9	8	(2)	United Kingdom 4; West Germany 1; Ivory Coast 1.
Metal including alloys, all forms	964	683	79	Netherlands 115; Belgium-Luxembourg 104; West Germany 98.
Columbium and tantalum: Metal including alloys, all forms:				
Columbium (niobium)	(2)	(2)	--	Mainly to Belgium-Luxembourg.
Tantalum	32	17	(2)	West Germany 16; United Kingdom 1.
Copper:				
Ore and concentrate	341	620	--	West Germany 608; Switzerland 12.
Matte and speiss including cement copper	2,042	1,171	--	Spain 632; Belgium-Luxembourg 330; United Kingdom 121.
Oxides and hydroxides	77	73	--	West Germany 35; Algeria 14; Morocco 8.
Sulfate	2,307	229	--	Spain 84; Netherlands 44; Italy 22.
Ash and residue containing copper	11,427	13,688	114	Belgium-Luxembourg 10,805; Spain 1,497; West Germany 1,140.
Metal including alloys:				
Scrap	128,602	121,832	84	West Germany 46,627; Italy 32,171; Belgium-Luxembourg 26,986.
Unwrought	16,913	15,311	2	Belgium-Luxembourg 7,458; West Germany 3,307; Switzerland 1,722.
Semimanufactures	243,300	256,226	8,685	West Germany 78,226; Italy 51,329; Spain 15,757.
Germanium: Metal including alloys, all forms	6	7	2	United Kingdom 4; Japan 1.

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Gold:				
Waste and sweepings value, thousands	$16,415	$6,786	--	United Kingdom $3,430; Spain $1,788; Belgium-Luxembourg $1,176.
Metal including alloys, unwrought and partly wrought thousand troy ounces	1,125	868	32	United Kingdom 289; Belgium-Luxembourg 193; West Germany 64.
Hafnium: Metal including alloys, all forms	1	(2)	(2)	
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	4,628	4,619	(2)	Belgium-Luxembourg 4,617; Italy 1.
Pyrite, roasted do	--	(2)	--	All to Republic of South Africa.
Metal:				
Scrap do	3,961	3,161	(2)	Italy 1,308; Spain 922; Belgium-Luxembourg 398.
Pig iron, cast iron, related materials	294,638	73,260	54	Italy 37,418; Spain 12,455; West Germany 11,239.
Ferroalloys:				
Ferrochromium	334	9,345	--	Belgium-Luxembourg 6,164; United Kingdom 2,207; West Germany 658.
Ferromanganese	238,968	641,913	69,724	Belgium-Luxembourg 99,150; Italy 98,523.
Ferromolybdenum	1,162	990	--	Netherlands 471; West Germany 267; Italy 214.
Ferronickel	55,671	33,280	--	Italy 9,789; West Germany 9,778; Sweden 5,478.
Ferrosilicochromium	346	2	--	All to Cameroon.
Ferrosilicomanganese	18,352	21,861	--	Saudi Arabia 8,420; Belgium-Luxembourg 5,488; West Germany 5,149.
Ferrosilicon	75,916	67,534	3,068	West Germany 19,553; Japan 14,920; Italy 14,629.
Silicon metal	23,791	NA		
Unspecified	37,803	32,961	4,015	West Germany 5,849; Italy 3,534; Belgium-Luxembourg 2,556.
Steel, primary forms thousand tons	3,089	3,150	426	Italy 864; Belgium-Luxembourg 317.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	2,781	2,382	224	West Germany 522; Belgium-Luxembourg 281; Italy 276.
Universals, plates, sheets do	3,469	3,348	275	West Germany 748; Italy 403.
Hoop and strip do	471	477	8	West Germany 177; Belgium-Luxembourg 70; Italy 62.
Rails and accessories do	158	165	15	China 32; Algeria 24; Mauritius 16.
Wire do	234	225	47	West Germany 54; United Kingdom 13.
Tubes, pipes, fittings do	1,547	1,235	73	U.S.S.R. 484; West Germany 142; Netherlands 78.
Castings and forgings, rough do	73	81	6	West Germany 31; Belgium-Luxembourg 16.
Lead:				
Ore and concentrate	15	11	3	Algeria 6; Israel 1.
Oxides	12,953	9,089	--	U.S.S.R. 2,850; Belgium-Luxembourg 1,041; Czechoslovakia 811.
Ash and residue containing lead	11,269	15,594	--	West Germany 9,183; Belgium-Luxembourg 6,294; Netherlands 47.
Metal including alloys:				
Scrap	12,630	7,105	--	West Germany 3,284; Italy 2,092; Belgium-Luxembourg 1,074.
Unwrought	59,779	57,878	16	Belgium-Luxembourg 17,689; West Germany 17,221; Netherlands 6,884.
Semimanufactures	2,120	1,565	4	Belgium-Luxembourg 667; Denmark 243; Italy 169.
Lithium:				
Oxides and hydroxides	48	21	--	All to West Germany.
Metal including alloys, all forms	1	--		

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Magnesium: Metal including alloys:				
Scrap	608	337	--	Netherlands 115; West Germany 102; Italy 95.
Unwrought	6,934	7,385	1,122	West Germany 2,309; Italy 489.
Semimanufactures	1,293	1,038	(2)	Italy 599; West Germany 372; Romania 15.
Manganese:				
Ore and concentrate, metallurgical-grade	73,755	95,250	2,540	Norway 68,110; Italy 9,657; Poland 5,610.
Oxides	1,723	898	--	Netherlands 210; Belgium-Luxembourg 205; Italy 192.
Metal including alloys, all forms	5,790	4,015	189	West Germany 1,197; Belgium-Luxembourg 749; Italy 489.
Mercury 76-pound flasks	1,653	2,581	NA	Netherlands 2,088; Belgium-Luxembourg 232; West Germany 116.
Molybdenum:				
Ore and concentrate	193	4,961	--	Netherlands 3,470; United Kingdon 514; West Germany 284.
Oxides and hydroxides	1	172	--	All to Netherlands.
Metal including alloys:				
Scrap	71	84	2	Italy 35; West Germany 24; Belgium-Luxembourg 12.
Unwrought	110	76	30	India 16; Austria 14.
Semimanufactures	98	131	(2)	West Germany 56; United Kingdom 48; Italy 6.
Nickel:				
Ore and concentrate	64	103	--	West Germany 102; Netherlands 1.
Matte and speiss	1	45	--	Belgium-Luxembourg 23; Netherlands 22.
Oxides and hydroxides	30	8	--	Netherlands 5; Turkey 2; Italy 1.
Ash and residue containing nickel	1,715	1,210	4	Sweden 395; Netherlands 287; West Germany 127.
Metal including alloys:				
Scrap	3,636	3,110	327	West Germany 733; Netherlands 550; Belgium-Luxembourg 435.
Unwrought	6,220	6,941	2,268	West Germany 2,004; Belgium-Luxembourg 774.
Semimanufactures	5,702	5,911	472	West Germany 3,293; Libya 619.
Platinum-group metals:				
Waste and sweepings value, thousands	$7,453	$5,184	--	United Kingdom $3,000; Belgium-Luxembourg $1,275; Italy $757.
Metals including alloys, unwrought and partly wrought troy ounces	304,994	192,906	NA	Switzerland 96,453; United Kingdom 32,151.
Rare-earth metals including alloys, all forms	81	60	7	West Germany 19; United Kingdom 17; Netherlands 9.
Rhenium: Metal including alloys, all forms	(2)	1	(2)	Mainly to Belgium-Luxembourg.
Selenium, elemental	25	5	--	Belgium-Luxembourg 3; West Germany 1.
Silicon, high-purity	51	43	1	Japan 39; West Germany 3.
Silver:				
Ore and concentrate[3] value, thousands	$4,266	$3,403	--	Sweden $3,402; Gabon $1.
Waste and sweepings do.	$17,267	$4,686	--	Switzerland $1,981; West Germany $885; United Kingdom $863.
Metal including alloys, unwrought and partly wrought thousand troy ounces	17,265	24,403	32	United Kingdom 10,771; Switzerland 5,851; West Germany 3,022.
Tellurium, elemental and arsenic	81	203	20	Turkey 35; Belgium-Luxembourg 30; India 30.
Tin:				
Ore and concentrate	7	2,091	--	Italy 2,072; West Germany 18.
Oxides	27	64	--	Netherlands 47; Belgium-Luxembourg 9; West Germany 7.
Ash and residue containing tin	191	29	--	West Germany 20; Belgium-Luxembourg 9.

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Tin —Continued				
Metal including alloys:				
Scrap	352	321	--	Belgium-Luxembourg 136; West Germany 101; United Kingdom 72.
Unwrought	447	196	--	Belgium-Luxembourg 51; Switzerland 41; Netherlands 35.
Semimanufactures	148	141	--	Angola 16; Guinea 15; Spain 14.
Titanium:				
Ore and concentrate	247	108	--	Ivory Coast 58; West Germany 22; Cameroon 10.
Oxides	27,957	29,758	12,733	West Germany 5,123; Italy 2,113.
Metal including alloys:				
Scrap	1,189	868	142	United Kingdom 452; Spain 216.
Unwrought	2	60	(2)	West Germany 42; Morocco 15; Spain 3.
Semimanufactures	526	260	17	Republic of Korea 83; United Kingdom 56; West Germany 42.
Tungsten:				
Ore and concentrate	484	353	--	Sweden 261; Japan 72; Austria 20.
Oxides and hydroxides	50	55	--	Romania 30; Hungary 15; Austria 5.
Ash and residue containing tungsten	3	--		
Metal including alloys:				
Scrap	293	209	5	West Germany 154; Japan 23; Belgium-Luxembourg 15.
Unwrought	133	124	--	West Germany 37; United Kingdom 21; Switzerland 19.
Semimanufactures	73	93	(2)	Switzerland 55; Belgium-Luxembourg 8; West Germany 6.
Uranium and/or thorium: Metal including alloys, all forms, uranium	3	14	3	Belgium-Luxembourg 10; Sweden 1.
Vanadium:				
Ore and concentrate	(2)	8	8	
Oxides and hydroxides	10	182	1	West Germany 69; Netherlands 42; Belgium-Luxembourg 40.
Ash and residue containing vanadium	181	323	--	Italy 205; West Germany 88; Belgium-Luxembourg 30.
Metal including alloys:				
Scrap	120	94	--	West Germany 48; Italy 46.
Unwrought	--	(2)	--	All to West Germany.
Semimanufactures	(2)	(2)	(2)	Mainly to Sweden.
Zinc:				
Ore and concentrate	102,857	85,555	--	Belgium-Luxembourg 53,488; Italy 31,614; United Kingdom 443.
Oxides	22,162	17,775	57	Belgium-Luxembourg 3,642; Romania 3,202; West Germany 3,186.
Blue powder	3,752	3,825	--	West Germany 1,858; Italy 752; Netherlands 473.
Matte	3,949	4,554	--	Italy 1,990; West Germany 1,012; Spain 940.
Ash and residue containing zinc	11,473	17,294	--	Belgium-Luxembourg 11,010; West Germany 2,946; Spain 1,665.
Metal including alloys:				
Scrap	11,502	14,102	--	Italy 4,999; West Germany 2,158; Belgium-Luxembourg 2,045.
Unwrought	71,060	65,126	7,414	West Germany 23,985; Belgium-Luxembourg 6,468.
Semimanufactures	32,790	35,195	89	Belgium-Luxembourg 15,573; West Germany 13,035; Denmark 2,418.
Zirconium:				
Ore and concentrate	175	415	--	West Germany 223; United Kingdom 121; Netherlands 26.
Metal including alloys:				
Scrap	45	--		
Unwrought	125	5	--	All to Sweden.
Semimanufactures	475	--		
Other:				
Ores and concentrates	169	212	153	Ivory Coast 48; West Germany 8.
Oxides and hydroxides	144	148	21	West Germany 69; United Kingdom 14.
Ashes and residues	18,468	35,881	1,442	West Germany 20,553; Belgium-Luxembourg 5,857; Sweden 4,949.
Base metals including alloys, all forms	125	343	16	Japan 306; West Germany 2.

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	1,383	1,190	3	Spain 300; Tunisia 160; Martinique 101.
Artificial:				
Corundum	20,706	19,647	1,339	Italy 3,777; West Germany 3,117; Austria 2,120.
Silicon carbide	2,459	NA		
Dust and powder of precious and semi-precious stones including diamond value, thousands	$873	$647	$108	Italy $292; Switzerland $69.
Grinding and polishing wheels and stones	8,689	8,182	912	Netherlands 1,706; Italy 1,125; United Kingdom 828.
Asbestos, crude	980	448	--	Tunisia 191; Poland 70; Guadeloupe 54.
Barite and witherite	95,171	98,185	74	West Germany 95,003; Italy 1,866; Belgium-Luxembourg 356.
Boron materials:				
Crude natural borates	4,920	3,896	--	Spain 3,522; Italy 136; Belgium-Luxembourg 124.
Elemental	(2)	(2)	--	Mainly to Algeria.
Oxides and acids	23,454	NA		
Bromine	721	NA		
Cement thousand tons	2,630	2,087	627	West Germany 336; Cameroon 216.
Chalk	676,944	600,292	973	West Germany 271,000; Belgium-Luxembourg 90,489; Switzerland 43,656.
Clays, crude:				
Bentonite	8,297	8,020	--	West Germany 3,175; Portugal 2,340; Italy 804.
Chamotte earth	151,176	112,490	--	Italy 37,442; West Germany 20,705; United Kingdom 18,730.
Fuller's earth	5,460	2,546	--	Italy 2,488; Ivory Coast 21; Spain 21.
Kaolin	136,228	172,116	6	West Germany 40,609; Belgium-Luxembourg 38,595; United Arab Emirates 30,330.
Unspecified	318,431	302,890	40	Italy 130,479; West Germany 84,542; Spain 17,488.
Cryolite and chiolite	41	98	--	Canada 85; Spain 8; Denmark 3.
Diamond:				
Gem, not set or strung value, thousands	$70,451	$58,340	$10,289	Switzerland $37,577; Belgium-Luxembourg $3,501.
Industrial stones do	$1,608	$1,622	$190	Belgium-Luxembourg $777; Ireland $590.
Diatomite and other infusorial earth	32,337	31,731	1	West Germany 10,877; Italy 4,502; Belgium-Luxembourg 3,065.
Feldspar, fluorspar, related materials:				
Feldspar	53,524	46,848	--	Spain 16,811; Belgium-Luxembourg 12,522; West Germany 7,287.
Fluorspar	56,187	45,703	60	Italy 17,891; West Germany 17,792; Belgium-Luxembourg 4,803.
Unspecified	39	51	--	Austria 24; West Germany 24; Spain 1.
Fertilizer materials:				
Crude, n.e.s	49,435	53,751	1	West Germany 33,262; Switzerland 13,067; Belgium-Luxembourg 3,076.
Manufactured:				
Ammonia	143,094	193,573	--	West Germany 87,561; United Kingdom 52,627; Spain 18,993.
Nitrogenous	651,059	487,127	813	Belgium-Luxembourg 104,013; Netherlands 66,976; Austria 57,800.
Phosphatic	205,611	160,632	--	Switzerland 59,087; Italy 29,845; Austria 23,825.
Potassic	433,726	309,283	--	Belgium-Luxembourg 92,283; West Germany 57,019; Switzerland 48,432.
Unspecified and mixed	553,666	486,805	21	West Germany 109,181; Belgium-Luxembourg 81,082; Ireland 50,639.
Graphite, natural	815	498	18	West Germany 203; Italy 83; United Kingdom 61.

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Gypsum and plaster -- thousand tons --	1,294	1,309	(2)	West Germany 711; Belgium-Luxembourg 369; Netherlands 134.
Iodine	62	98	--	West Germany 40; Belgium-Luxembourg 17; United Kingdom 12.
Kyanite and related materials	180	115	--	Greece 83; Sweden 24; Switzerland 6.
Lime	319,809	295,460	462	West Germany 197,441; Belgium-Luxembourg 67,140; Guinea 13,215.
Magnesium compounds:				
Magnesite, crude	980	515	--	Switzerland 446; Italy 48; Netherlands 19.
Oxides and hydroxides	13,237	15,897	10	Italy 4,575; West Germany 3,213; Belgium-Luxembourg 1,221.
Other	424	241	--	Spain 165; Martinique 75; Tunisia 1.
Mica:				
Crude including splittings and waste	7,729	6,902	5	United Kingdom 2,524; West Germany 1,895; Belgium-Luxembourg 416.
Worked including agglomerated splittings	1,200	1,365	44	Switzerland 302; West Germany 268; United Kingdom 131.
Nitrates, crude	1	6	--	All to Gabon.
Phosphates, crude	4,239	3,202	--	Cameroon 1,785; Switzerland 987; West Germany 299.
Phosphorus, elemental	1,570	2	--	West Germany 1; Togo 1.
Pigments, mineral:				
Natural, crude	1,173	34	--	Italy 24; Andorra 10.
Iron oxides and hydroxides, processed	4,570	5,877	6	Italy 2,840; West Germany 1,104; Spain 768.
Potassium salts, crude	7,889	6,710	--	Belgium-Luxembourg 6,604; Switzerland 104; Spain 2.
Precious and semiprecious stones other than diamond:				
Natural ----- value, thousands	$39,902	$38,094	$1,459	Switzerland $29,067; United Kingdom $2,551; Hong Kong $1,505.
Synthetic ----------do----	$9,540	$17,395	$1,713	Switzerland $10,877; Mauritius $2,423.
Pyrite, unroasted	151	38	--	Belgium-Luxembourg 20; Republic of South Africa 18.
Salt and brine	740,237	747,003	51,412	Italy 272,492; Brazil 140,059; West Germany 121,064.
Sodium compounds, n.e.s.: Carbonate, manufactured	239,940	242,294	427	Belgium-Luxembourg 34,466; Argentina 29,501; Republic of South Africa 24,903.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked thousand tons	117	126	1	Belgium-Luxembourg 52; West Germany 26; Switzerland 19.
Worked----------do----	61	68	5	Belgium-Luxembourg 26; West Germany 16; Switzerland 7.
Dolomite, chiefly refractory-grade do----	29	34	--	Spain 7; Ivory Coast 4; Netherlands 4.
Gravel and crushed rock ---do----	9,300	9,905	4	West Germany 4,437; Switzerland 2,908; Netherlands 1,505.
Limestone other than dimension do----	544	536	--	West Germany 455; Belgium-Luxembourg 57; Netherlands 12.
Quartz and quartzite------do----	7	11	(2)	Italy 7; West Germany 2; Belgium-Luxembourg 1.
Sand other than metal-bearing do----	3,502	3,644	(2)	West Germany 1,938; Switzerland 736; Belgium-Luxembourg 251.
Sulfur:				
Elemental:				
Crude including native and by-product	537,878	367,695	15	United Kingdom 119,582; Netherlands 43,484; Algeria 43,435.
Colloidal, precipitated, sublimed	5,177	2,223	--	West Germany 656; Belgium-Luxembourg 630; United Kingdom 283.
Dioxide	714	2,006	--	Belgium-Luxembourg 1,607; Netherlands 316; Belgium-Luxembourg 50.
Sulfuric acid	232,562	210,890	17	Belgium-Luxembourg 135,896; United Kingdom 26,100; Ireland 15,828.

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Talc, steatite, soapstone, pyrophyllite	103,471	99,542	369	West Germany 30,977; Netherlands 14,772; Belgium-Luxembourg 12,604.
Vermiculite, perlite, chlorite	135	365	--	Saudi Arabia 144; Algeria 64; Belgium-Luxembourg 60.
Other:				
Crude thousand tons	1,523	1,352	(2)	Belgium-Luxembourg 1,135; Switzerland 191; West Germany 15.
Slag and dross, not metal-bearing do	1,090	1,064	(2)	West Germany 563; Belgium-Luxembourg 169; Israel 155.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	81,082	92,584	--	Belgium-Luxembourg 89,664; United Kingdom 2,140; Morocco 138.
Carbon:				
Carbon black	2,439	2,730	94	Italy 999; Spain 492; West Germany 445.
Gas carbon	97,684	85,166	--	West Germany 21,764; Spain 18,895; United Kingdom 14,455.
Coal:				
Anthracite	82,837	60,546	--	Italy 22,742; Belgium-Luxembourg 18,211; Tunisia 11,605.
Bituminous	957,856	643,338	--	West Germany 376,200; Ireland 72,653; Norway 66,561.
Briquets of anthracite and bituminous coal	63,067	32,726	--	Belgium-Luxembourg 2,100; United Kingdom 5,057; West Germany 4,727.
Lignite including briquets	1,748	2,167	--	All to Spain.
Coke and semicoke	647,313	548,037	--	West Germany 104,171; Belgium-Luxembourg 78,815; Norway 73,194.
Gas, natural: Gaseous million cubic feet	12,435	6,847	--	Switzerland 4,466; Belgium-Luxembourg 2,376; Tunisia 5.
Peat including briquets and litter	2,283	4,352	--	West Germany 2,394; United Kingdom 1,416; Belgium-Luxembourg 219.
Petroleum:				
Crude thousand 42-gallon barrels	5	1	--	Mainly to Austria.
Refinery products:				
Liquefied petroleum gas do	9,342	9,755	680	Spain 3,187; Italy 1,821; Morocco 850.
Gasoline do	17,045	16,096	2,142	West Germany 2,987; Switzerland 2,962; Netherlands 2,818.
Mineral jelly and wax do	496	531	1	West Germany 264; Netherlands 125; Morocco 27.
Kerosene and jet fuel do	6,763	6,012	124	Switzerland 2,508; West Germany 986; United Kingdom 959.
Distillate fuel oil do	25,048	23,923	991	Switzerland 9,548; West Germany 8,070; Netherlands 1,062.
Lubricants do	6,169	6,742	346	Belgium-Luxembourg 1,390; West Germany 1,082; Netherlands 603.
Residual fuel oil do	27,634	28,395	1,663	Italy 7,334; United Kingdom 5,080; Portugal 3,705.
Bitumen and other residues do	657	1,425	--	United Kingdom 422; Belgium-Luxembourg 291; West Germany 205.
Bituminous mixtures do	282	234	--	Algeria 92; Belgium-Luxembourg 40; West Germany 18.
Petroleum coke do	85	2	(2)	Mainly to Belgium-Luxembourg.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	943	845	1	United Kingdom 803; Italy 28; West Germany 14.
Alkaline-earth metals	419	412	3	U.S.S.R. 248; China 75; Canada 73.
Aluminum:				
Ore and concentrate	1,002,750	910,754	21,015	Guinea 476,856; Australia 232,695; Turkey 66,075.
Oxides and hydroxides	138,926	124,649	690	Guinea 62,725; West Germany 26,220; Italy 19,937.
Ash and residue containing aluminum	12,977	10,556	11	West Germany 4,756; Italy 2,732; Cameroon 1,282.
Metal including alloys:				
Scrap	53,273	58,817	1,143	Belgium-Luxembourg 17,979; Netherlands 17,284; United Kingdom 9,397.
Unwrought	395,912	428,055	400	Netherlands 82,247; West Germany 75,907; Norway 54,888.
Semimanufactures	224,894	267,131	1,115	West Germany 85,926; Belgium-Luxembourg 61,813; Italy 21,945.
Antimony:				
Ore and concentrate	12,074	11,783	--	China 6,355; Bolivia 2,115; Morocco 994.
Oxides	662	640	10	Belgium-Luxembourg 337; China 88; United Kingdom 58.
Metal including alloys, all forms	431	377	(2)	China 111; U.S.S.R. 67; Thailand 41.
Arsenic: Oxides and acids	409	461	(2)	United Kingdom 162; Italy 156; West Germany 116.
Beryllium:				
Oxides and hydroxides	(2)	24	(2)	Italy 23.
Metal including alloys, all forms	4	10	5	West Germany 3; Italy 2.
Bismuth: Metal including alloys, all forms	207	305	(2)	Belgium-Luxembourg 200; United Kingdom 57; Peru 30.
Cadmium: Metal including alloys, all forms	892	888	(2)	Belgium-Luxembourg 395; Netherlands 269; Republic of Korea 45.
Cesium and rubidium: Metal including alloys, all forms	(2)	(2)	(2)	
Chromium:				
Ore and concentrate	25,094	24,610	--	Republic of South Africa 14,842; Netherlands 2,992; Albania 2,028.
Oxides and hydroxides	5,893	6,986	54	United Kingdom 3,220; West Germany 1,926; Italy 833.
Metal including alloys, all forms	198	232	2	United Kingdom 117; Japan 51; Belgium-Luxembourg 23.
Cobalt:				
Ore and concentrate	--	(2)	(2)	
Oxides and hydroxides	202	281	--	Belgium-Luxembourg 116; Finland 77; Canada 14.
Metal including alloys, all forms	1,376	1,244	136	Zambia 298; Zaire 296.
Columbium and tantalum:				
Ore and concentrate	--	(2)	--	All from Netherlands.
Ash and residue containing columbium and tantalum	--	38	--	All from Zaire.
Metal including alloys, all forms:				
Columbium (niobium)	73	23	1	West Germany 21.
Tantalum	48	36	30	West Germany 5; Austria 1.
Copper:				
Ore and concentrate	285	79	--	All from Australia.
Matte and speiss including cement copper	--	946	--	All from East Germany.
Oxides and hydroxides	764	784	--	Belgium-Luxembourg 206; Norway 164; Italy 136.
Sulfate	4,541	4,846	--	Italy 1,918; Spain 933; Belgium-Luxembourg 620.
Ash and residue containing copper	4,658	4,442	--	Sweden 1,100; Belgium-Luxembourg 888; West Germany 467.
Metal including alloys:				
Scrap	34,412	43,114	338	United Kingdom 12,125; West Germany 7,380; Netherlands 4,350.
Unwrought	351,455	361,662	964	Chile 113,855; Belgium-Luxembourg 97,627; Zambia 59,667.
Semimanufactures	176,646	180,001	1,518	West Germany 60,546; Belgium-Luxembourg 53,830; Italy 31,963.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Germanium: Metal including alloys, all forms	6	6	4	Japan 1.
Gold:				
Waste and sweepings value, thousands	$4,605	$11,615	--	Switzerland $10,222; Belgium-Luxembourg $659; Netherlands $299.
Metal including alloys, unwrought and partly wrought thousand troy ounces	3,633	2,829	1,897	Philippines 418; Switzerland 129.
Hafnium: Metal including alloys, all forms	1	3	2	China 1.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	16,220	16,191	(2)	Brazil 4,032; Sweden 2,470; Australia 2,356.
Pyrite, roasted do	49	52	--	Belgium-Luxembourg 25; Italy 23; Spain 2.
Metal:				
Scrap	460,985	352,546	588	West Germany 147,380; Belgium-Luxembourg 130,561; United Kingdom 47,480.
Pig iron, cast iron, related materials	510,366	403,887	4,492	West Germany 320,222; Canada 27,788; United Kingdom 27,670.
Ferroalloys:				
Ferrochromium	160,071	168,119	20	Republic of South Africa 82,483; Finland 35,759; Sweden 15,627.
Ferromanganese	35,480	64,309	55	Norway 17,417; Portugal 13,018; West Germany 10,390.
Ferromolybdenum	1,514	1,566	--	Netherlands 466; United Kingdom 402; Austria 259.
Ferronickel	106,700	79,875	--	New Caledonia 61,918; Netherlands 5,012; Colombia 2,876.
Ferrosilicochromium	493	500	--	West Germany 308; Zimbabwe 147; Netherlands 25.
Ferrosilicomanganese	39,064	58,888	--	Norway 43,188; Portugal 5,698; Belgium-Luxembourg 5,468.
Ferrosilicon	38,525	34,761	23	West Germany 14,173; Norway 12,355; Italy 4,971.
Silicon metal	6,763	7,947	10	Norway 2,889; Brazil 2,068; Sweden 1,677.
Unspecified	7,110	10,841	--	France 8,763; West Germany 1,204; Italy 175.
Steel, primary forms thousand tons	2,252	2,137	(2)	Belgium-Luxembourg 1,231; West Germany 445; Italy 184.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	2,107	2,252	3	Italy 624; West Germany 619; Belgium-Luxembourg 506.
Universals, plates, sheets do	2,357	2,390	(2)	Belgium-Luxembourg 1,079; West Germany 494; Italy 224.
Hoop and strip do	398	399	(2)	West Germany 195; Belgium-Luxembourg 90; Italy 51.
Rails and accessories do	56	55	--	United Kingdom 27; Belgium-Luxembourg 25; West Germany 2.
Wire do	220	240	(2)	Belgium-Luxembourg 71; West Germany 63; Italy 61.
Tubes, pipes, fittings do	539	542	(2)	Italy 179; West Germany 132; Belgium-Luxembourg 51.
Castings and forgings, rough do	45	47	(2)	West Germany 24; Italy 6; Belgium-Luxembourg 4.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Lead:				
Ore and concentrate	190,536	182,378	3,700	Republic of South Africa 37,334; Peru 26,077; Ireland 18,008.
Oxides	1,572	3,905	5	West Germany 2,873; United Kingdom 730; Belgium-Luxembourg 182.
Ash and residue containing lead	14,663	16,938	--	Italy 5,250; Australia 3,710; Netherlands 3,240.
Metal including alloys:				
Scrap	9,279	14,644	--	Belgium-Luxembourg 5,024; Netherlands 4,389; Switzerland 3,341.
Unwrought	41,107	37,099	23	United Kingdom 17,372; West Germany 7,648; Belgium-Luxembourg 7,141.
Semimanufactures	5,936	6,703	10	Belgium-Luxembourg 4,967; West Germany 1,336; United Kingdom 212.
Lithium:				
Oxides and hydroxides	473	329	36	West Germany 114; China 98; Netherlands 40.
Metal including alloys, all forms	18	41	1	United Kingdom 24; West Germany 16.
Magnesium: Metal including alloys:				
Scrap	349	244	--	Netherlands 169; Norway 20; West Germany 16.
Unwrought	4,347	4,689	1,066	Norway 2,453; Spain 626.
Semimanufactures	459	479	17	Italy 174; Switzerland 129; West Germany 55.
Manganese:				
Ore and concentrate, metallurgical-grade	1,039,791	760,987	2	Gabon 485,014; Republic of South Africa 189,294; Brazil 35,786.
Oxides	8,183	7,969	44	Belgium-Luxembourg 4,264; West Germany 1,888; Greece 722.
Metal including alloys, all forms	825	1,183	13	Republic of South Africa 467; Netherlands 362; Belgium-Luxembourg 197.
Mercury 76-pound flasks	4,582	5,452	NA	Spain 3,480; Algeria 580; West Germany 377.
Molybdenum:				
Ore and concentrate	5,677	7,447	1,643	Canada 2,357; Netherlands 1,276.
Oxides and hydroxides	145	124	--	United Kingdom 49; West Germany 22; Belgium-Luxembourg 20.
Metal including alloys:				
Scrap	49	76	--	West Germany 32; Austria 26; Netherlands 14.
Unwrought	85	78	15	Netherlands 20; Austria 14.
Semimanufactures	128	94	19	Austria 47; Netherlands 16.
Nickel:				
Ore and concentrate	--	20	--	All from Republic of South Africa.
Matte and speiss	13,600	13,534	2	New Caledonia 12,785; Canada 452; Austria 220.
Oxides and hydroxides	204	146	(2)	Netherlands 78; Canada 39; Australia 22.
Ash and residue containing nickel	1,660	386	20	Belgium-Luxembourg 106; West Germany 48.
Metal including alloys:				
Scrap	942	669	2	United Kingdom 281; Yugoslavia 132; Belgium-Luxembourg 87.
Unwrought	19,774	18,557	528	U.S.S.R. 4,119; West Germany 3,862; Republic of South Africa 2,283.
Semimanufactures	4,851	5,763	1,378	United Kingdom 1,702; West Germany 1,181.
Platinum-group metals:				
Waste and sweepings value, thousands	$23,292	$27,416	$1,135	West Germany $10,562; Netherlands $3,798; Turkey $2,864.
Metals including alloys, unwrought and partly wrought thousand troy ounces	965	1,543	32	West Germany 1,190; Switzerland 64; United Kingdom 64.
Rare-earth metals including alloys, all forms	235	205	5	Austria 168; Brazil 30.
Rhenium: Metal including alloys, all forms	(2)	(2)	(2)	
Selenium, elemental	35	54	(2)	Canada 16; Netherlands 14; United Kingdom 7.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Silicon, high-purity	60	234	5	Brazil 102; Norway 86; Belgium-Luxembourg 22.
Silver:				
Ore and concentrate[3]				
value, thousands	$2,720	$7,249	$30	Bolivia $3,579; Philippines $1,160; Peru $1,064.
Waste and sweepings ——do——	$4,666	$7,628	$1,726	Greece $2,334; West Germany $1,388.
Metal including alloys, unwrought and partly wrought				
thousand troy ounces	18,648	24,949	4,340	Greece 3,344; West Germany 2,379.
Tellurium, elemental and arsenic	113	260	45	Peru 100; China 61.
Tin:				
Ore and concentrate	1	--		
Oxides	99	102	(2)	United Kingdom 47; West Germany 36; Italy 19.
Ash and residue containing tin	26	--		
Metal including alloys:				
Scrap	15	15	--	Netherlands 10; Malaysia 5.
Unwrought	7,126	8,288	55	Malaysia 2,570; Indonesia 1,683; Netherlands 989.
Semimanufactures	367	227	3	West Germany 107; Netherlands 103; United Kingdom 6.
Titanium:				
Ore and concentrate	233,056	265,718	1	Canada 137,963; Australia 65,233; Malaysia 27,063.
Oxides	8,762	5,484	64	West Germany 2,521; Belgium-Luxembourg 1,649; Netherlands 482.
Metal including alloys:				
Scrap	132	167	22	West Germany 77; United Kingdom 21.
Unwrought	1,169	627	109	Japan 480; United Kingdom 25.
Semimanufactures	1,400	982	555	United Kingdom 135; Japan 122.
Tungsten:				
Ore and concentrate	352	180	29	Canada 72; China 42.
Oxides and hydroxides	27	26	--	West Germany 21; Italy 5.
Metal including alloys:				
Scrap	87	29	--	West Germany 21; Belgium-Luxembourg 4; Israel 2.
Unwrought	185	111	2	West Germany 87; United Kingdom 12; Belgium-Luxembourg 6.
Semimanufactures	59	55	4	West Germany 15; Austria 11; Netherlands 10.
Uranium and/or thorium:				
Ore and concentrate	15,514	15,923	741	Australia 11,872; Malaysia 1,391; Thailand 1,049.
Metal including alloys, all forms:				
Uranium	14	116	89	United Kingdom 25; Belgium-Luxembourg 2.
Thorium	--	(2)	(2)	Mainly from West Germany.
Vanadium:				
Oxides and hydroxides	2,217	1,416	(2)	China 520; Republic of South Africa 408; Belgium-Luxembourg 215.
Metal including alloys:				
Unwrought	137	35	--	All from West Germany.
Semimanufactures	4	(2)	--	Mainly from West Germany.
Zinc:				
Ore and concentrate	540,117	513,512	4,719	Peru 130,495; Canada 95,004; Sweden 92,648.
Oxides	8,120	7,842	2	West Germany 2,464; Italy 1,587; Netherlands 1,409.
Blue powder	1,041	2,583	(2)	Belgium-Luxembourg 2,221; West Germany 194; Netherlands 125.
Matte	4,897	3,896	--	Belgium-Luxembourg 1,996; United Kingdom 942; West Germany 886.
Ash and residue containing zinc	39,382	36,384	1,360	Belgium-Luxembourg 13,551; Peru 6,966; West Germany 5,658.
Metal including alloys:				
Scrap	5,590	7,529	718	Belgium-Luxembourg 2,912; Netherlands 1,349; West Germany 788.
Unwrought	89,236	98,809	(2)	Netherlands 28,468; Belgium-Luxembourg 28,268; West Germany 20,800.
Semimanufactures	10,301	9,315	2	West Germany 5,247; Netherlands 1,429; Belgium-Luxembourg 749.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Zirconium:				
Ore and concentrate	51,305	38,932	516	Australia 27,696; Republic of South Africa 4,630; Netherlands 3,478.
Metal including alloys:				
Scrap	105	98	41	West Germany 35; United Kingdom 8.
Unwrought	21	(2)	(2)	
Semimanufactures	51	57	44	Belgium-Luxembourg 8; West Germany 3.
Other:				
Ores and concentrates	16,024	40,565	--	Spain 31,767; Peru 4,180; West Germany 2,705.
Oxides and hydroxides	869	563	15	Belgium-Luxembourg 349; United Kingdom 86; Switzerland 51.
Ashes and residues	22,485	22,470	183	Italy 8,868; Spain 8,140; West Germany 4,533.
Base metals including alloys, all forms	9	6	1	United Kingdom 2; Belgium-Luxembourg 1.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	9,758	13,870	623	Italy 3,419; Turkey 3,196; West Germany 2,678.
Artificial:				
Corundum	10,429	10,999	310	West Germany 4,112; Austria 2,548; U.S.S.R. 1,865.
Silicon carbide	17,799	21,583	172	Norway 6,275; West Germany 5,350; Italy 2,984.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$8,636	$8,805	$2,558	Ireland $5,213; United Kingdom $435.
Grinding and polishing wheels and stones	10,226	10,474	74	Italy 2,987; West Germany 2,083; Belgium-Luxembourg 1,527.
Asbestos, crude	63,874	65,067	81	Canada 28,943; U.S.S.R. 15,541; Italy 10,406.
Barite and witherite	43,660	35,552	23	Belgium-Luxembourg 10,315; West Germany 10,202; Morocco 5,106.
Boron materials:				
Crude natural borates	83,289	69,939	754	Turkey 68,743; United Kingdom 211.
Elemental	1,199	1,114	(2)	United Kingdom 1,111; West Germany 3.
Oxides and acids	1,651	2,313	502	Italy 1,449; Turkey 127.
Bromine	6,784	4,800	32	Israel 3,221; United Kingdom 851; East Germany 357.
Cement	429,641	424,225	2	Belgium-Luxembourg 339,047; West Germany 54,194; Italy 22,579.
Chalk	36,905	32,987	22	West Germany 23,093; Belgium-Luxembourg 9,345; Italy 118.
Clays, crude:				
Bentonite	98,366	88,062	1,759	Greece 37,456; Italy 30,466; West Germany 7,005.
Chamotte earth	8,777	4,744	--	West Germany 3,690; Czechoslovakia 917; United Kingdom 111.
Fuller's earth	1,922	2,978	113	West Germany 1,298; Belgium-Luxembourg 1,077.
Kaolin	310,457	309,699	43,195	United Kingdom 190,524; Czechoslovakia 20,267.
Unspecified	250,254	283,936	1,261	West Germany 186,292; Senegal 56,654; Spain 18,126.
Cryolite and chiolite	615	729	--	Denmark 622; Greenland 106; United Kingdom 1.
Diamond:				
Gem, not set or strung value, thousands	$172,683	$147,077	$6,651	Switzerland $52,512; Belgium-Luxembourg $37,661; India $13,073.
Industrial stones ---do---	$4,249	$2,600	$25	Belgium-Luxembourg $987; Ireland $686; Zaire $253.
Diatomite and other infusorial earth	7,216	5,755	2,349	West Germany 2,251; Spain 470.
Feldspar, fluorspar, related materials:				
Feldspar	23,497	23,627	--	West Germany 15,723; Spain 2,806; Portugal 2,783.
Fluorspar	13,151	12,991	--	Spain 8,407; West Germany 3,544; United Kingdom 590.
Unspecified	44,136	40,247	--	Norway 37,228; Netherlands 1,699; Canada 1,020.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Fertilizer materials:				
Crude, n.e.s	31,872	33,878	2	Belgium-Luxembourg 17,759; West Germany 5,148; Netherland 5,146.
Manufactured:				
Ammonia thousand tons	464	237	(2)	Trinidad and Tobago 64; Netherlands 40; Belgium-Luxembourg 36.
Nitrogenous do	2,731	2,980	154	Netherlands 1,070; Belgium-Luxembourg 948.
Phosphatic do	846	619	7	Belgium-Luxembourg 168; Netherlands 122; Tunisia 117.
Potassic do	940	816	--	Belgium-Luxembourg 138; Canada 134; Israel 119.
Unspecified and mixed do	1,636	1,634	86	Belgium-Luxembourg 873; Netherlands 249; Tunisia 96.
Graphite, natural	5,277	5,572	59	China 1,957; West Germany 1,051; Austria 920.
Gypsum and plaster	39,219	90,749	141	West Germany 58,487; Switzerland 14,297; Spain 8,085.
Iodine	894	867	--	Japan 627; Chile 203; United Kingdom 16.
Kyanite and related materials	3,452	4,718	1,135	West Germany 1,275; Republic of South Africa 1,138.
Lime	102,752	82,514	--	West Germany 61,864; Belgium-Luxembourg 6,501; United Kingdom 6,013.
Magnesium compounds:				
Magnesite, crude	53	100	--	Netherlands 69; West Germany 12; United Kingdom 11.
Oxides and hydroxides	171,556	76,806	--	Norway 37,243; West Germany 19,206; Spain 11,212.
Other	105,651	113,453	--	West Germany 66,485; East Germany 33,656; Belgium-Luxembourg 13,293.
Mica:				
Crude including splittings and waste	4,309	4,846	102	India 2,548; Morocco 1,440; Canada 251.
Worked including agglomerated splittings	244	280	1	Japan 90; Belgium-Luxembourg 89; Switzerland 40.
Nitrates, crude	8,374	6,965	--	Chile 6,907; Spain 50; West Germany 7.
Phosphates, crude thousand tons	4,254	3,567	659	Morocco 978; Israel 583.
Phosphorus, elemental	120	128	50	West Germany 46; Belgium-Luxembourg 41.
Pigments, mineral:				
Natural, crude	226	152	--	West Germany 66; Italy 53; Netherlands 33.
Iron oxides and hydroxides, processed	50,139	31,759	564	West Germany 24,301; Belgium-Luxembourg 2,787; Italy 1,628.
Potassium salts, crude	120	24,392	--	U.S.S.R. 14,618; Spain 9,665; Belgium-Luxembourg 79.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$80,290	$73,236	$3,885	Switzerland $39,993; Thailand $10,819; United Kingdom $4,016.
Synthetic do	$4,795	$7,123	$1,205	Switzerland $2,155; Mauritius $2,143.
Pyrite, unroasted	1,177	1,144	2	Italy 885; West Germany 142; Spain 67.
Salt and brine	151,575	154,332	14	Belgium-Luxembourg 44,632; Netherlands 38,609; West Germany 33,990.
Sodium compounds, n.e.s.: Carbonate, manufactured	62,400	55,040	(2)	West Germany 25,988; Poland 20,681; Belgium-Luxembourg 7,832.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked thousand tons	282	271	(2)	West Germany 58; Republic of South Africa 57; Italy 40.
Worked do	269	289	(2)	Spain 162; Italy 90; West Germany 16.
Dolomite, chiefly refractory-grade do	284	283	--	Belgium-Luxembourg 246; Italy 23; West Germany 12.
Gravel and crushed rock do	3,592	3,694	(2)	Belgium-Luxembourg 3,146; United Kingdom 241; West Germany 128.
Limestone other than dimension do	178	187	--	Belgium-Luxembourg 186.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel —Continued				
Quartz and quartzite thousand tons	290	301	(2)	Belgium-Luxembourg 266; Spain 25; Italy 7.
Sand other than metal-bearing do	2,072	1,919	(2)	Belgium-Luxembourg 965; United Kingdom 690; Netherlands 175.
Sulfur:				
Elemental:				
Crude including native and by-product	624,351	532,969	22,265	Poland 241,980; Canada 211,467; West Germany 31,524.
Colloidal, precipitated, sublimed	78	141	8	Spain 76; West Germany 26; Italy 23.
Dioxide	1,050	2,455	--	Sweden 970; West Germany 701; Netherlands 560.
Sulfuric acid	140,988	143,070	4	West Germany 84,167; Belgium-Luxembourg 42,874; United Kingdom 10,841.
Talc, steatite, soapstone, pyrophyllite	16,145	17,929	415	Italy 5,043; Belgium-Luxembourg 4,552; Austria 3,388.
Vermiculite, perlite, chlorite	64,854	78,570	--	Republic of South Africa 21,744; U.S.S.R. 20,204; Greece 13,246.
Other:				
Crude thousand tons	2,074	2,764	1	Switzerland 2,378; Norway 133; Spain 115.
Slag and dross, not metal-bearing do	2,155	2,018	4	West Germany 1,063; Belgium-Luxembourg 714; Netherlands 83.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,568	2,064	668	Belgium-Luxembourg 1,372; United Kingdom 20.
Carbon:				
Carbon black	6,778	8,211	560	West Germany 2,843; United Kingdom 2,106; Netherlands 1,231.
Gas carbon	81,699	81,279	668	West Germany 41,623; Netherlands 21,938; Spain 8,392.
Coal:				
Anthracite thousand tons	1,284	1,463	(2)	West Germany 488; Republic of South Africa 464; United Kingdom 246.
Bituminous do	17,173	15,780	4,795	Australia 4,657; West Germany 1,782.
Briquets of anthracite and bituminous coal do	121	115	--	West Germany 113; Belgium-Luxembourg 1; Italy 1.
Lignite including briquets do	151	154	--	West Germany 134; East Germany 19; Hungary 1.
Coke and semicoke do	2,777	1,496	134	West Germany 877; Netherlands 251; Belgium-Luxembourg 191.
Gas, natural:				
Gaseous million cubic feet	701,983	793,983	--	U.S.S.R. 265,208; Netherlands 242,087; Norway 153,822.
Liquefied thousand tons	5,746	5,946	--	Algeria 5,945; Netherlands 1.
Peat including briquets and litter	321,486	378,256	--	West Germany 218,410; Netherlands 92,676; Belgium-Luxembourg 25,291.
Petroleum:				
Crude thousand 42-gallon barrels	501,201	486,316	--	Saudi Arabia 112,286; United Kingdom 63,211; Nigeria 46,172.
Refinery products:				
Liquefied petroleum gas do	12,589	15,311	(2)	United Kingdom 5,448; Saudi Arabia 2,666; Algeria 2,101.
Gasoline do	41,947	64,551	306	U.S.S.R. 9,706; Netherlands 9,414; Italy 8,445.
Mineral jelly and wax do	145	313	12	Netherlands 145; West Germany 64; United Kingdom 27.
Kerosene and jet fuel do	1,675	2,844	26	Italy 1,085; United Kingdom 413; Belgium-Luxembourg 386.
Distillate fuel oil do	51,699	70,647	472	Italy 11,034; U.S.S.R. 10,469; United Kingdom 8,986.
Lubricants do	970	1,050	55	Belgium-Luxembourg 180; West Germany 171; Italy 148.
Residual fuel oil do	50,660	40,035	365	U.S.S.R. 6,930; Belgium-Luxembourg 6,325; Saudi Arabia 3,941.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products —Continued				
Bitumen and other residues thousand 42-gallon barrels	459	1,624	(2)	Belgium-Luxembourg 629; West Germany 370; Spain 254.
Bituminous mixtures do	40	38	(2)	Belgium-Luxembourg 14; West Germany 8; Netherlands 4.
Petroleum coke do	7,135	9,888	8,954	United Kingdom 295; West Germany 290.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

COMMODITY REVIEW

METALS

Bauxite and Alumina.—Aluminium Pechiney S.A. continued work on a 5,000-ton-per-year facility at its Gardanne plant near Marseilles designed to produce high-purity alumina for ceramics applications. The new unit was expected to cost $3.4 million and was scheduled to commence operations at the end of 1987.

Aluminium Pechiney depleted its reserves at Engadin, and, in response to sharp price drops for bauxite, closed its Peygros Mine. In addition, the company undertook a gradual phaseout of its La Brasque, Recoux, and Canonettes Mines near Brignoles in southeastern France. However, the company planned to maintain a reserve of 3,000 tons of bauxite at Peygros, to be released in the event of a price improvement.

In tandem with the mine closures, Pechiney scheduled elimination of 1,700 jobs at its Aluminium Pechiney and Pechiney Électrométallurgie subsidiaries as part of its plan to move away from unprofitable activities into specialist product niches. About 67% of the jobs eliminated was within Aluminium Pechiney.

Copper.—Pechiney and the Italian metal group, Società Metallurgica Italiana (SMI), agreed to merge their copper-processing activities into a joint company named Europeene de Metallurgie. Under the mechanics of the merger, Trafilerie e Laminatoi di Metalli (TLM), owned 60% by Pechiney, was the hub of the transaction. Specifically, SMI acquired 30% of TLM's capital from Pechiney. TLM then absorbed Pechiney's French copper subsidiary Trefimetaux and SMI's copper subsidiary La Metalli Industriale (LMI), of which SMI was a 57% shareholder. Upon completion of the deal, Pechiney and SMI retained 51% of TLM capital, with SMI holding a greater share. The accord also provided that, although daily operations would be controlled by SMI, strategic decisions would be made jointly. It was expected that the added capital strength of the new company would allow the enterprise to focus on production and sales aimed at growth areas such as electronics and telecommunications. Moreover, its output could amount to 20% of the European market, making it Europe's leading copper processor.

Ferroalloys.—Pechiney Électrométallurgie closed its Saint Beron ferrosilicon plant in Haute-Savoie. The shutdown, in part a result of the company's planned rationalization and reduction of ferrosilicon output, was spurred by low demand and an inability of prices to compensate for high energy and labor costs. Pechiney could no longer compete with low-cost producers such as Brazil, China, and Venezuela.

In another development, Pechiney curtailed production of ferrovanadium at its Chedde plant, 30 kilometers west of Geneva. The plant, with a capacity of 250 tons per month, produced only 50 to 100 tons per month. Reliant on Sinochem, a Chinese supplier, for limited amounts of vanadium pentoxide at relatively high prices, Pechiney did not enjoy the high volume and price

supports accorded its competition by other suppliers. Consequently, ferrovanadium production was not profitable for the company.

Gallium.—Rhône-Poulenc S.A., the large French chemicals producer, continued to operate the world's largest gallium extraction plant at Salindres. With a capacity of 20,000 kilograms per year of gallium, the extraction plant accepted Bayer liquor from Pechiney's Gardanne alumina refinery. Pechiney recovered the alumina from bauxite mined locally and in Guinea. The 4N gallium produced by Rhône-Poulenc was refined to high levels of purity, 6N and 7N, at Salindres and then sold, principally to the United States and Japan.

Iron and Steel.—Of major importance in the iron and steel sector in 1987 was the merger of Usinor and Sacilor, thereby creating one of Europe's largest producer of flat-rolled steel, with an annual output of 10 million tons. The flat products operations of each company were consolidated into a single branch composed of Usinor Aciers, Solmer and Sollac, and their associated tube-making and coil-coating companies such as Galvanor and GTS Industries de Sedan S.A. The new group was organized into five product divisions: plate and pipe, hot-rolled products, cold-rolled products, coated sheet, and tinplate. In addition, sales were assigned to three groups: domestic, export, and tinplate.

The merger also eliminated 17,000 jobs, or 15% of the work force, with a view toward making the company and the French steel industry competitive. Moreover, the new operation reduced new project investments from $750 million in 1986 to $500 million per year from 1987 forward. A total of $83 million was allocated to modernizing the company's mills in France's Lorraine region. Of this amount, $41 million would go toward transforming the bar-rod mill at Gandrange into a single-strand, nontwist mill. The remaining outlays were earmarked for modernization work at mills owned by Unimetal, the Usinor-Sacilor subsidiary in Lorraine, including the Rombas mills, the Hayange rail mill, and the Longwy section and rod mills. Also, the Nueves-Maisons and Gandrange works melting shops were to be upgraded with installation of ladle refining.

The new steel group was committed to cutting back its iron ore mining and pig iron production segments. Noteworthy were the closures of Usinor-Sacilor's two blast furnaces at Jouef, near Metz, the iron ore mine at nearby Hayange, and the beneficiation plant at Suzange. The shutdowns resulted in a cutback of 1 million tons of pig iron capacity and reflected reductions in operating and investment expenditures.

Polymetallics.—Mining feasibility studies were completed by the state-owned BRGM on its Chessy copper-zinc-barite deposit, 30 kilometers from Lyon. Proven ore reserves of 3.7 million tons were identified, averaging 2.23% copper, 9.6% zinc, and trace amounts of barite and pyrite. In addition, a flotation plant was designed. Pilot plant treatment of 500 tons per hour was successful. In light of this, BRGM and its mining subsidiary entered into talks aimed at establishing a financial partnership to include joint ventures with third parties. Capital outlays for a 300,000-ton-per-year-capacity underground mine at Chessy were estimated to be $50 million.

INDUSTRIAL MINERALS

Fertilizer Materials.—Norsk Hydro A/S, the Norwegian industrial minerals conglomerate, gained 100%-ownership control of the French fertilizer manufacturer, Cie. Française de l'Azote (Cofaz), after purchasing the remaining 20% share in the company. Cofaz had 10 major manufacturing operations. The most important of these were at Le Havre, Rouen, and Montoir, where the company's primary products were urea, complex fertilizers, and ammonium nitrate.

In addition to streamlining operations and modernizing plants at its new acquisitions, Norsk Hydro planned to build a nitric acid plant at Ambes, on the Gironde River, 25 kilometers north of Bordeaux. The new $137 million facility was expected to produce daily 1,500 tons of ammonium nitrate and 1,150 tons of nitric acid.

CdF Chimie closed its Chasse-sur-Rhône plant, near Lyon. The facility had an annual production capacity of 300,000 tons each of ammonium nitrate and nitric acid. The shutdown was said to be part of a strategic move that included merger discussions between CdF Chimie and Grande Paroisse, the fertilizer subsidiary of L'Air Liquide, the industrial gases company. Under the merger, CdF Chimie would control the new enterprise and all three plants of Grande Paroisse with total annual capacities of 45,000 tons of ammonium nitrate, 25,000 tons of mixed fertilizers, and 13,000 tons of nitrate solutions.

CdF Chimie-AZF and Ciments et Engrais de Dannes et de l'Est (CEDEST) entered into a joint venture, creating Sud Fertilisants, a new company. Under the arrangement, CdF Chimie-AZF's L'Oseraie and Balaruc plants in southern France were turned over to CEDEST, cutting CdF Chimie's phosphate fertilizer capacity by about 10% to 15%. The two plants had a combined annual production capacity of 500,000 tons of phosphates and mixed fertilizers. The joint venture was to allow CEDEST to build on its already substantial access to phosphate raw materials and to increase its presence in the French market.

Magnesia.—Pechiney Électrométallurgie increased the capacity of its fused magnesia plant at Chedde to an annual output of 28,000 tons at a cost of nearly $1 million to match the increased demand for electrofused magnesia in home electrical appliances, and to meet the strong demand for magnesia-carbon refractories, a market segment that the company planned to develop. Electrofused magnesia is utilized extensively in products that require its high-heat-transfer capability and electrical resistivity.

Phosphate Rock.—As part of an industry-wide drive to eliminate small and less economic phosphoric acid plants in France, Société Pec-Rhin began a gradual phaseout of its 50,000-ton-per-year phosphoric acid facility at Ottmarsheim, near Mulhouse, Alsace. The company, owned 50% by BASF AG, the West German chemicals producer, and 50% by Société Chimique de la Grande Paroisse, planned a complete shutdown by March 1988. France's annual P_2O_5 output from the five remaining phosphoric acid units would be 888,000 tons.

Sulfuric Acid and Soda Ash.—Rhône-Poulenc purchased from Imperial Chemical Industries PLC (United Kingdom) the U.S. sulfuric acid, soda ash, and phosphorus production operations of Stauffer Chemical Co. for $522 million. The acquisition was to enable the company to gain a manufacturing and marketing foothold in the United States.

Société de la Vieille-Montagne SA dismantled one of its two smelter-gas-based sulfuric-acid-production units at Viviez. Designed by Produits Chimiques Ugine Kuhlmann and built by Krebs, the unit commenced its run in 1968 and was part of a plant capable of producing annually 75,000 tons of sulfuric acid. Vieille-Montagne planned to continue sulfuric acid production at Calais.

MINERAL FUELS

Coal.—Beset by reduced demand for domestic coal because of lower oil prices and because of coal imports made less expensive by a falling dollar, CdF Chimie began a multipronged restructuring of its operations. The first element called for the closure of unprofitable mines, most notably in the 1.7-million-ton-per-year Nord-Pas-de-Calais region of northern France, thereby eliminating 12,000 miners by 1992. In response, 2,200 of these workers staged a strike. At issue was CdF Chimie's offer to pay each of those miners between $24,000 and $46,000 to return to Morocco from which they had come during the past decade.

The expected layoffs at Nord-Pas-de-Calais were part of a broader plan to eliminate 30,000 jobs, leaving the coal producer with approximately 11,000 employees. A Government subsidy of $582 million was placed in a special fund to pay severed miners. The subsidy was necessary because state funds allocated to separated workers left insufficient state funding to permit plant modernization.

An additional Government subsidy was sought by CdF Chimie to reduce its debt burden by $330 million, the second element of its restructuring effort. The company had reduced its operating deficit from $166 million in 1985 to $16.6 million in 1986 by disposing of many of its assets. However, the disposition, along with the need to provide capital for its employment reduction program, caused the coal producer to post estimated operating losses of $324 million and a total loss of $1.36 billion in 1987.

Government funds totaling $550 million were also made available to implement the third element of its restructuring: improved productivity. Investments were to be made primarily in the more cost-efficient eastern region of Lorraine, where the La Houve and Merlebach mines were among the most profitable. Output from the Lorraine region was 9.9 million tons for the year.

The high cost of coal mining in France compared with the price of imported coal was expected to cause a 5- to 12-million-ton drop in output by 1992 down about one-half of the output in 1987. This would permit CdF Chimie to pursue the final element of its rationalization plan: allocating its resources to developing and exporting its expertise in coal mine development, mine safety, coal transportation systems, and

coal utilization.

Nuclear Power.—The Creys-Malville nuclear breeder reactor plant was shut down indefinitely in late May for repair of a storage tank that had leaked sodium coolant. Work was expected to take more than 1 year at a cost of $67 million. The ruptured tank contained about 700 tons of sodium, of which about 0.5 ton had leaked. The leak sealed itself when the temperature was lowered.

Earlier in the year, a nuclear reactor at Saint-Laurent-des-Eaux was shut down for approximately 1 hour. The plant at Saint-Laurent had two 15-year-old, gas-cooled reactors on an artificial island in the Loire River about 170 kilometers south of Paris. The shutdown was caused by a power failure to blowers circulating carbon dioxide coolant through the graphite reactor tubes. The power failure was in response to the shutting off of water flow to the heat exchangers of the reactor caused by water freezing at the intake filters. Although the problem was solved relatively quickly with a switch to alternate energy sources, the residual heat in the core could have caused serious damage and might have resulted in a major nuclear accident if the problem had not been alleviated quickly.

Petroleum.—Elf, the French oil company, and Institut Française du Pétrole, France's nonprofit petroleum research agency, developed a horizontal oil-well-drilling technique that eliminated many of the obstacles precluding its widespread application.

This breakthrough was significant for two reasons. First, oil reservoirs are vertical fractures within horizontal rock layers where oil accumulates. Thus, horizontal wells can tap far more of these fractures from one drilling platform during a single drilling trial at less cost than would be possible with a vertical hole. Second, given that the oil layer nearly always floats on water, the horizontal technique eliminates the suctioning of water cones into the oil layer that attends vertical drilling.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted French francs (F) to U.S. dollars at the rate of F6.01 = US$1.00, the average rate in 1987.

The Mineral Industry of Gabon

By David J. Ellis[1]

Despite the continued depression of oil prices, Gabon's principal source of export revenue, 1987 was relatively a buoyant year for the mineral industry.

Although oil production decreased slightly, compared with production in 1986, there was renewed interest in oil exploration after discovery of the important Rabi-Kounga onshore oilfield in 1986. Another oil well was discovered in August 1987 to the north of the Rabi-Kounga Field, and there was increased participation in bidding for onshore concessions.

Work commenced on handling and loading facilities at both ends of the Trans-Gabon Railroad, which was completed in December 1986. Engineering contracts for the port complex at Owendo, and the loading-storage facility at the Moanda manganese mine, were awarded to consortia of European firms. The Trans-Gabon Railroad was expected to carry the first payload of manganese by yearend 1988.

A minerals inventory and mapping program of the regions surrounding the Trans-Gabon Railroad, ongoing since 1980, led to the discovery of a large carbonatite deposit containing columbium, rare-earth metals, yttrium, titanium, tin, and other potentially viable commodities. The deposit was found southeast of Lambarene, on a densely forested plateau. Further evaluation of the deposit was proceeding in order to gain a better idea of its extent and composition.

PRODUCTION AND TRADE

Gabon, like many other countries whose economies are heavily dependent on revenue from oil exports, was forced to retrench its public- and private-sector economies in the wake of the plunge in oil prices in late 1985. Income from oil exports, which accounted for more than 90% of total revenue, decreased more than 50% from 1985 to 1986 and only recovered slightly in 1987.

A rescheduling of debt, a cutback in Government spending, and a new standby loan agreement with the International Monetary Fund were the Government of Gabon's responses to the crisis in 1986, and these policies continued through 1987.

After positive growth of gross domestic product (GDP) in 1984 and 1985, GDP growth was a negative 2% in 1986, and was expected to be a negative 10% to 14% in 1987. Although the trade balance remained positive throughout the past 4 years, it declined from $1.1 billion[2] in 1985 to $81 million in 1986, before recovering to approximately $500 million in 1987. Total export revenues rose slightly between 1986 and 1987, going from slightly more than $1 billion to approximately $1.25 billion, while imports were reduced from $970 million to slightly more than $700 million during the same period.

Foreign debt and the debt service ratio (percentage of income used to service the debt) more than doubled between 1985 and 1987. In 1985, foreign debt was $803 million and debt service was 13%, compared with about $2 billion and 28% in 1987.

Oil production and exports were down slightly from 1986 levels, in volumetric terms, as a result of decreasing yields from the older fields, and continued to be in compliance with the Organization of Petroleum Exporting Countries quota of 159,000

barrels per day maximum production. However, several new fields were scheduled to come on-stream in the near future; by 1990, oil production could approach the peak levels reached in the mid-1970's.

Production and exports of manganese ore also dropped slightly, although production of high-grade battery ore more than doubled from previous year levels. On completion of the loading and handling facilities for manganese ore on the Trans-Gabon Railroad, scheduled for yearend 1988, the production capacity of the Moanda manganese mine will rise from the current 2.7 million tons per year to 4.0 million tons per year. Because of increased marketing, Gabon's manganese exports to Eastern Europe increased by 35%, compared with that of 1986.

Uranium production decreased for the second consecutive year, probably in response to continued sluggish demand. France's Commissariat a l'Energie Atomique remained the principal purchaser of uranium exports, taking about 70%; Belgium, Italy, and Japan received most of the balance.

France remained Gabon's main trading partner in 1987, providing about 50% of imports and receiving more than 30% of exports. Gabon's second largest trading partner was the United States, which provided about 7% of Gabon's imports (mainly aircraft and machinery) and received about 20% of Gabonese exports, of which approximately 90% were oil and 4% were manganese ore. Other major sources and/or markets for Gabonese trade were Japan and Western Europe.

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

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
Cement, hydraulic metric tons	120,000	207,916	244,768	[3]210,858	[4]137,400
Diamond, gem and industrial[e] carats	550	550	550	500	--
Gas, natural:					
Gross million cubic feet	66,300	74,484	[e]75,000	70,000	80,000
Marketed do	4,800	4,800	[r e]4,000	3,000	4,000
Gold, mine output, metal content troy ounces	550	1,325	1,608	2,000	[4]2,500
Manganese:					
Ore, gross weight (50% to 53% Mn) metric tons	1,761,752	2,037,760	2,281,000	2,440,000	[4]2,216,000
Pellets, battery- and chemical-grade, gross weight (82% to 85% MnO_2) do	94,834	81,102	59,000	70,000	[4]187,000
Total do	1,856,586	2,118,862	2,340,000	2,510,000	[4]2,403,000
Petroleum:					
Crude thousand 42-gallon barrels	56,815	61,582	62,307	60,000	[4]57,000
Refinery products:					
Gasoline do	613	490	523	480	500
Jet fuel and kerosene do	721	703	776	530	500
Distillate fuel oil do	1,566	1,465	1,690	1,380	1,400
Residual fuel oil do	2,705	1,285	2,912	1,130	1,100
Other do	66	129	[e]135	[e]100	100
Refinery fuel and losses do	193	148	[e]200	[e]130	150
Total do	5,864	4,220	[e]6,236	[e]3,750	3,750
Uranium oxide (U_3O_8), content of concentrate metric tons	1,006	1,000	1,225	1,100	950

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

[1]Table includes data available through June 20, 1988.

[2]In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) is also produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.

[3]Of the cement produced, 202,198 tons was from domestic clinker.

[4]Reported figure.

COMMODITY REVIEW

METALS

Columbium.—In October, the Gabonese Government announced the discovery of columbium, among other minerals, in a large carbonatite deposit found during an ongoing mineral inventory and mapping exercise along the route of the Trans-Gabon Railroad. The deposit was found on a low-lying plateau 40 kilometers southeast of the city of Lambarene, which itself lies about 150 kilometers southeast of the capital, Libreville.

The terrain was flat, undeveloped, and thickly forested. Exploration has been conducted in the vicinity since 1984, and 11 drill samples were taken to delineate the deposit. These preliminary drillings revealed the magnitude of the deposit to be at least 30 million cubic meters, with zonation of the different elements in varying concentrations.

Geologic reserves of columbium, in the form of pyrochlore, were estimated to be approximately 750,000 metric tons of Cb_2O_5, which would make it the second largest known deposit, behind the Araxa deposit in Brazil.

Among the other potentially exploitable commodities in the deposit were an estimated 30 million tons of iron ore, 6 million tons of phosphate rock the equivalent of 3 million tons of TiO_2 contained in ilmenite, and the equivalent of 600,000 tons of rare-earth metals and yttrium contained in an alumino-phosphate known as florencite.

The Gabonese Ministry of Mines and Hydrocarbons, in conjunction with Bureau de Recherches Géologiques et Minières of France, was making further studies of the deposit in order to gain a clearer picture of the mineralogy and reserves.

Iron Ore.—Development of the Haut-Ivindo iron ore deposits near Belinga continued to be postponed because of depressed world markets.

Manganese.—After initial problems with financing, details of the Owendo ore terminal project were finalized in midyear. The project financing originally had been expected to be met partially by Government funding, but the decline in Gabon's oil revenues in 1985 and 1986 led to the need for new sources of financing. Compagnie Minière de l'Ogooué S.A. (COMILOG) was given control of the ore port project to ensure coordination with the manganese mining operations. A joint-venture company named Société du Port Mineralier d'Owendo (PMO) was formed in midyear, with COMILOG as 18% shareholder. Other financing came in part as private investment from Gabonese investors, and the remainder came in the form of loans from various lending organizations.

COMILOG, as operator of the ore terminal, is to pay PMO a royalty on each ton of manganese ore exported. The royalty payment, along with tolls from other users of the railroad and port facilities, will allow loans to be repaid and investors remunerated.

The Trans-Gabon Railroad became fully operational toward the end of the year. The work in progress during 1987, and that scheduled for 1988, was planned to allow transport and loading of manganese ore by yearend 1988. However, even after the system is fully functional, some of the manganese ore will continue to be transported via the aerial tramway-railroad system to the port at Pointe Noire in the neighboring Congo, as it has been during COMILOG's operations.

Ore-handling systems were needed at the Moanda and Owendo Mines. Contracts for the work were given to two European consortia under the names G. I. Moanda and G. I. Owendo, both of which were headed by REI of France. A system of curved conveyors with a maximum throughput of 800 tons per hour is planned to move the ore from the Moanda Mine to a wagon-loading station 7 kilometers away. An intermediate storage area with a 60,000-ton capacity was also planned. At Owendo, the wagons are planned to be unloaded by a car-dumper manufactured by Krupp GmbH (Federal Republic of Germany), one of the consortia members. A 600,000-ton storage area at Owendo is planned to be serviced by a stacker-reclaimer with a capacity of 3,000 tons per hour. From this storage area, the ore will be conveyed to the ship loader by a belt conveyer system, the final portion of which will be on a platform above water.

The engineering contract for the mineral port itself was eventually awarded to a consortium of firms led by Spie Batignolles S.A. of France, despite earlier reports that Raymond International Inc. of Houston, TX, would be supervising the construction.

Facilities include a sand platform to contain the rail system used for the turnaround of the wagons, the car-dumper, and the remainder of the handling system, including the transformers. Fourteen offshore runway piers were built to support the loading conveyor platform and a swiveling shiploader. The port facility was designed to load 40,000-metric-ton-deadweight vessels.

The approximate costs of the various project phases were as follows: $9.5 million for the Moanda handling system, $10.5 million for the Owendo handling system, and $70 million for the port facility itself, making a total cost of $90 million.[3]

INDUSTRIAL MINERALS

Barite.—The exploitation of the barite deposits in the Dourakiki Mountains was postponed due to a lack of financing for the project. The cost of setting up the infrastructure for a planned 30,000-ton-per-year operation was estimated at $11 million in 1986.

Fertilizer Materials.—Crowe Schaffalitzky and Associates (CSA), a team of consultants from Ireland, was hired to assess the potential of Gabon's raw materials by the Commission of the European Communities. CSA advised the Gabonese Government to utilize local sources of dolomite, limestone, and phosphate rock as fertilizers to increase crop yields, rather than to import processed fertilizers. The locally available minerals could be applied directly to crops after reduction by a small, portable crushing-grinding unit.[4]

MINERAL FUELS

Petroleum.—The ramifications of the Rabi-Kounga discovery were manifested in various ways, most notably by increased interest in onshore exploration. Rabi-Kounga was named for the Rabi and Kounga wells, drilled in 1985 and 1986, respectively, which provided first proof of the field. The discoveries were made in the Sette Cama concession operated by Shell-Gabon Oil Co. (a subsidiary of Royal Dutch/Shell) 50%, in partnership with Elf-Gabon (a subsidiary of Société Nationale Elf Aquitaine (SNEA) 30%, and SNEA, 20%. Subsequently, it was discovered to overlap slightly into the Dianongo Block to the north, which is held by the same partners but with Elf-Gabon as operator.

Plans for development of the field were announced in 1987, with actual production scheduled to commence in early 1989. Development plans include the drilling of 53 wells linked to a central production unit. This unit would also serve as a logistics base and have an airstrip and lodging for up to 50 people. Approximately 100 kilometers of roads would be needed to provide access to the remote site set in a tropical rain forest. Initial plans were for a pipeline to Shell-Gabon's export terminal at Gamba, 135 kilometers to the south, to provide for the first stage of production, scheduled to be 20,000 barrels per day. By the time the field reaches peak production of 80,000 barrels per day in 1990, a second, 210-kilometer pipeline will have been built to connect with Elf-Gabon's export terminal at Cap Lopez (near Port Gentil). The pipeline to Cap Lopez will have a capacity of 120,000 barrels per day to allow additional production, if needed.

Development costs for the Rabi-Kounga Field were estimated to be between $450 and $500 million, which left Shell-Gabon in the position of having to look for financing for much of its commitment because of a negative cash flow from existing Gabonese operations. Elf-Gabon and SNEA, however, were expected to provide some self-financing.[5]

The Rabi-Kounga discovery was also instrumental in stimulating bidding for exploration permits and in increasing exploration activity at onshore sites in the vicinity. This intensified activity was rewarded in August by an oil strike at the Dianongo Coucal-1 well in the Dianongo concession operated by Elf-Gabon. This well is approximately 20 kilometers northeast of the Rabi-Kounga Field. The well flowed almost 3,000 barrels per day of crude oil.

Among other new development activity, Tenneco Oil Exploration and Production Co. began offshore oil production and acquired exploration licenses for new concessions. Tenneco's 50-50 partner in the production of oil from the Obando Marin permit was London & Scottish Marine Oil PLC (LASMO). Tenneco has been involved with the three small fields southwest of Port Gentil since 1982, and reserves were estimated to be nearly 24 million barrels of oil. Production began in October and reached almost 11,000 barrels per day by yearend, somewhat less than the 15,000-barrel-per-day target.

Tenneco was also involved in the leasing of three new exploration tracts, as operator of joint ventures with different groups of companies, including LASMO, Norsk Hydro A.S. (Norway), Pennzoil Co. (United

States), and Wintershall Oil A.G. (Federal Republic of Germany). The three blocks totaled nearly 8,000 square kilometers, and were spread up and down the coastline.

Amoco Gabon Exploration Co., a consortium headed by Amoco Oil Co. of the United States, continued to produce oil at the Oquendjo Field, about 90 kilometers south-southwest of Port Gentil, where Amoco first began production in Gabon in 1983. Amoco's exploration activities in Gabon continued with the evaluation of the potential of the Gombe Marin permit.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Communauté Financiére Africaine (CFAF) francs to U.S. dollars at the rate of CFAF300=US$1.00. The official CFAF exchange rate was maintained at CFAF50 per French franc and was freely convertible.

[3]International Bulk Journal. COMILOG Details Gabon Manganese Ore Transport Project. V. 8, No. 5, May 1988, pp. 47-49.

[4]International Mining. V. 4, No. 11, Nov. 1987, p. 23.

[5]Oil and Gas Journal. V. 89, No. 20, May 16, 1988, p. 55.

The Mineral Industry of the German Democratic Republic

By George A. Rabchevsky[1]

The German Democratic Republic (GDR) was the most industrially advanced of the Council for Mutual Economic Assistance (CMEA) countries.[2] In 1987, the planned produced national income increase of 4.5% rose only 3% during midyear, and 4% at yearend, to about $143 billion.[3] The growth was about the same as in 1986 and was attributed mostly to the industrial sector. Because of the less-than-ideal economic performance, the Secretary-General, in his annual speech to the first secretaries of district organizations on February 12, criticized some sectors of the economy. He reportedly said that industry was plagued by unnecessary shutdowns, slowdowns caused by accidents, and poor labor discipline. Factories often stood idle because of poor planning and an inadequate infrastructure.[4] Nevertheless, the GDR continued to have a high standard of living, and the economic expansion was above average for CMEA countries. In the mining industry sector, the 1987 plan fulfillment statistics listed only coal and potash as significant commodities, combining all other industrial minerals, metals, and mineral fuels into broad categories.[5] The processing of metals and the recycling of scrap materials also contributed somewhat to the general economy. The general industry contributed about 80% to the produced national income, of which the metals, minerals, and mining industry was a significant component. In 1986, according to the latest official statistics, the energy and fuel sector contributed 7.6% to overall industrial production, metallurgy 9.4%, and the chemical industry (including fertilizers) 20.3%. Heavy industry employed 37.7% of the total work force, which included 226,330 workers from the energy and fuel industry, 138,086 from metallurgy, and 339,463 from the chemical industry. There were a total of 3,449 industrial enterprises, of which 241 were in the chemical, 49 in the energy, and 42 in the metallurgical sectors.[6]

The GDR had a well-established infrastructure and transportation network for the receipt and distribution of its raw materials. In 1986, coal and coke accounted for the largest volume of commodities transported by rail at 33.8%, followed by building materials, 23.2%; ores and metals, 9.8%; chemical products, 7.5%; and oil and oil products, 6%. Except for building materials and agricultural products, coal and coke accounted for the largest volume of commodities transported by inland waterways at 12.3% and by overland routes, 2.4%, followed by ores and metals, 7.7% and 1.1%, respectively. Reportedly, no oil or oil products were transported over public highways. A total of 25.51 million tons of cargo was handled at seaports, of which ores and metals constituted the largest category at 8.05 million tons, followed by fertilizers, 4.33 million tons; oil and oil products, 3.42 million tons; and coke and coal, 1.49 million tons. The port at Rostock handled 80% of the cargo.

PRODUCTION

The GDR's labor productivity in the national economy increased by 4%. In industry, net production reportedly rose by 6.3% and labor by 6.6%. The production of indus-

trial goods rose by 3.7% at reduced material and operating costs. In minerals production, the output remained about the same as in 1986. Production of some commodities decreased according to plan, while others were overproduced. The production of brown coal was below the 1986 level, and according to the plan fulfillment results, members of the armed forces helped in coal production operations.[7]

The collection and use of secondary raw materials and scrap continued to increase, amounting to 31 million tons in 1987. Of this, 5.5 million tons was collected as metal scrap, together with 1.3 billion bottles and other pieces of glass. The share of secondary materials in the production of raw steel and copper was 68% each and 100% for the production of lead. A total of $41.2 billion was reportedly spent for the modernization, renovation, or expansion of existing industrial production facilities, or 6% more than in 1986. This included the introduction of new processing technologies, such as electron beam and laser processing methods for cutting, welding, and materials heat treatment. Production began of grinding tools made of synthetic superhard cutting materials, of new refractory products for converter steel production, ladle metallurgy, powder-metallurgical materials, and ceramic materials. The number of industrial robots rose to 78,800, resulting in an 8% increase of products. The streamlining contributed to the savings in the utilization of energy, steel, and nonferrous stocks.

Table 1.—German Democratic Republic: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Alumina:					
For metallurgical use	42,156	43,239	46,695	46,350	46,500
For other use[e]	20,000	20,000	20,000	20,000	20,000
Metal:[e]					
Primary	57,000	58,000	60,000	r65,000	68,300
Secondary	52,000	52,000	52,000	52,000	52,000
Total	109,000	110,000	112,000	r117,000	120,300
Cadmium metal, primary[e]	15	15	15	r18	18
Copper:					
Mine output, Cu content[e]	12,000	12,000	12,000	10,000	9,000
Metal:					
Smelter, primary	17,000	14,000	14,000	12,000	12,000
Refined:[e]					
Primary	35,000	35,000	35,000	35,000	30,000
Secondary	33,000	30,000	28,000	28,000	28,000
Total	68,000	65,000	63,000	63,000	58,000
Iron and steel:					
Iron ore and concentrate thousand tons	40	36	30	--	--
Fe content do	20	20	15	--	--
Metal:					
Pig iron do	2,207	2,357	2,578	2,738	2,900
Ferroalloys, electric furnace do	128	124	124	135	135
Steel, crude do	7,219	7,573	7,853	7,967	8,200
Semimanufactures (hot-rolled only) do	5,084	5,386	5,637	5,656	5,800
Lead:[e]					
Smelter, primary	20,000	22,000	20,000	20,000	18,000
Refined, all sources	36,000	35,000	55,000	r46,000	45,000
Nickel:					
Mine output, Ni content, recoverable	2,200	2,000	2,000	2,000	2,000
Metal, refined[e]	3,000	3,000	3,000	r3,200	3,200
Silver, mine output, Ag content, recoverable thousand troy ounces	1,380	1,290	1,320	1,320	1,200
Tin:[e]					
Mine output, Sn content, recoverable	1,800	2,500	2,800	2,800	2,500
Metal, smelter output including secondary	2,000	3,000	3,300	3,000	2,500
Zinc metal including secondary	16,500	17,000	17,000	17,000	19,000
INDUSTRIAL MINERALS					
Barite[e]	35,000	35,000	34,000	34,000	32,000
Boron materials: Processed borax, $Na_2B_4O_7$• $10H_2O$ content[e]	4,000	4,000	4,000	4,000	4,000
Cement, hydraulic thousand tons	11,782	11,555	11,608	11,988	11,500

See footnotes at end of table.

Table 1.—German Democratic Republic: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Chalk[e] thousand tons	40	40	40	40	40
Clays, kaolin:[e]					
Crude do	400	350	350	330	320
Marketable do	200	175	175	165	150
Fluorspar[e] do	100	100	100	100	90
Gypsum and anhydrite:					
Crude[e] do	360	360	360	340	340
Calcined do	297	302	312	305	310
Lime and dead-burned dolomite do	3,458	3,597	3,567	3,545	3,525
Nitrogen: N content of ammonia do	1,206	1,203	1,206	1,193	1,315
Potash, marketable, K_2O equivalent do	3,431	3,465	3,465	3,485	3,500
Pyrite, gross weight[e] do	20	--	--	--	--
Salt:					
Marine do	56	58	58	59	58
Rock do	3,070	3,075	3,080	3,075	3,075
Total do	3,126	3,133	3,138	3,134	3,133
Sodium compounds, n.e.s.:					
Caustic soda do	687	694	667	638	615
Sodium carbonate do	887	890	884	885	887
Sodium sulfate do	152	164	172	181	188
Stone, sand and gravel:					
Crushed stone[e] do	16,000	14,500	15,000	15,000	14,500
Sand and gravel do	8,628	8,599	8,437	8,163	7,985
Sulfur:					
Byproduct:[e]					
Elemental do	90	80	80	75	75
Other forms do	270	270	250	240	240
Sulfuric acid do	926	885	883	883	870
MINERAL FUELS AND RELATED MATERIALS					
Coal, brown coal (lignite) do	277,968	296,341	312,000	311,260	309,000
Coke:					
From anthracite and bituminous coal[e] do	1,200	1,150	--	--	--
From brown coal:					
High-temperature do	2,510	2,463	2,497	2,509	2,515
Low-temperature do	3,210	3,327	3,185	3,092	3,010
Total do	6,920	6,940	5,682	5,601	5,525
Fuel briquets (from lignite) do	50,047	50,270	50,666	51,434	49,500
Gas:					
Manufactured million cubic feet	255,320	272,695	274,743	281,029	286,000
Natural, marketed production[e] do	353,000	459,000	459,000	459,000	459,100
Petroleum:					
Crude thousand 42-gallon barrels	383	430	[e]430	[e]360	360
Refinery products:					
Gasoline do	33,618	35,190	36,567	36,792	39,000
Kerosene, jet fuel, distillate fuel oil do	46,915	47,525	49,216	49,013	49,000
Residual fuel oil do	56,610	59,940	[e]60,000	[e]60,000	65,000
Lubricants do	3,238	3,231	3,346	3,317	3,300
Total[3] do	140,381	145,886	149,129	149,122	156,300

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

[1]Table includes data available through May 1988.

[2]In addition to the commodities listed, magnesium, peat, and a variety of construction materials are produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.

[3]Total of listed products only.

TRADE

The GDR relied heavily on foreign trade for its economic well-being, especially in the supply of raw materials. Primary foreign trade of the GDR was with CMEA countries and the neighboring Federal Republic of Germany (FRG). According to the 1987 plan results, the GDR's foreign trade turnover was more than $96 billion, 40% of which was with the U.S.S.R., its largest trading partner. An export surplus of $1.8 billion was reported in 1987. About 50% of the GDR's exports to the U.S.S.R. were specialized products, 70% of which were designated for the metalworking industry. The Soviet Union continued to supply raw materials to the GDR, thus replacing its diminishing indigenous minerals base and ensuring a steady supply of those materials to the national economy. The Soviet Union, virtually the sole supplier, reportedly delivered about 123 million barrels of oil, 247 million cubic feet of natural gas, and 3.3 million tons of rolled steel. Deliveries of gas and iron and steel increased sharply in 1987. From 50% to 70% of other mineral and metal commodities were imported from various other countries. Future development was based on continued and expanded ties with other countries, primarily because of lack of indigenous raw materials and improving the standard of living. This included some trade with the United States and renewed contacts with China, with which relations were broken off in the early 1960's. A trade protocol was signed also with Albania, under which the GDR would import chrome ore, copper wire, and various metallurgical products, in addition to other nonmineral commodities.

Table 2.—German Democratic Republic: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[p 2]	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkaline-earth metals	323	--		
Aluminum:				
Oxides and hydroxides	--	4	--	Finland 3; France 1.
Ash and residue containing aluminum	2,425	1,437	--	Netherlands 1,174; Belgium-Luxembourg 157; Spain 106.
Metal including alloys:				
Scrap	6,133	4,496	--	Netherlands 2,543; Belgium-Luxembourg 659; France 566.
Unwrought	25,007	7,630	--	Poland 5,019; Japan 2,003; United Kingdom 204.
Semimanufactures	22,343	7,373	19	Hungary 2,146; Sweden 1,850; Finland 704.
Cadmium: Metal including alloys, all forms	55	--		
Copper:				
Ore and concentrate	3,267	--		
Matte and speiss including cement copper	300	946	--	All to France.
Sulfate	18	8,707	--	Sweden 8,697; Greece 10.
Metal including alloys:				
Scrap	460	25	--	All to Belgium-Luxembourg.
Unwrought	11,202	6,769	7	Netherlands 3,607; France 2,072; Austria 791.
Semimanufactures	48,390	3,907	85	Austria 865; Hong Kong 837; Switzerland 664.
Gold: Metal including alloys, unwrought and partly wrought value, thousands	$2,417	$9,586	$50	Italy $9,536.
Iron and steel: Metal:				
Scrap	42,720	22,699	--	Thailand 15,063; Pakistan 4,000; Sweden 1,688.
Pig iron, cast iron, related materials	248	602	43	Switzerland 240; Sweden 232.
Ferroalloys:				
Ferromolybdenum	13	--		
Ferronickel	--	112	--	All to United Kingdom.
Ferrosilicon	5,904	--		
Silicon metal	1	--		
Unspecified	363	420	--	Finland 390; Netherland 30.

See footnotes at end of table.

Table 2.—German Democratic Republic: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p 2]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel: Metal —Continued				
Steel, primary forms thousand tons	122	141	(3)	Italy 69; Belgium-Luxembourg 32; Thailand 23.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	1,583	1,649	10	Hong Kong 76; Denmark 37; unspecified 1,366.
Universals, plates, sheets do	847	841	46	Thailand 53; Switzerland 38.
Hoop and strip do	588	579	--	Belgium-Luxembourg 2; Switzerland 2; unspecified 572.
Rails and accessories do	11	11	--	NA.
Wire do	45	63	(3)	Netherlands 4; Belgium-Luxembourg 2; unspecified 56.
Tubes, pipes, fittings do	4215	4197	1	Yugoslavia 23; France 20; Poland 17.
Castings and forgings, rough do	56	115	(3)	Switzerland 4; France 2; unspecified 107.
Lead:				
Oxides	836	2,104	--	Yugoslavia 1,510; Sweden 518; Denmark 41.
Metal including alloys:				
Scrap	479	88	--	All to Netherlands.
Unwrought	521	2,814	--	Netherlands 2,420; United Kingdom 394.
Semimanufactures	2	--		
Magnesium: Metal including alloys, semimanufactures	--	5	--	All to France.
Manganese: Ore and concentrate, metallurgical-grade	19	--		
Nickel: Metal including alloys:				
Scrap	--	67	--	All to Netherlands.
Unwrought	415	23	--	Netherlands 13; Austria 10.
Semimanufactures	37	3	--	All to Italy.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$2,918	$85	--	All to Netherlands.
Silicon, high-purity	1	--		
Silver:				
Metal including alloys, unwrought and partly wrought value, thousands	$62,245	$80,547	--	United Kingdom $80,538; Italy $9.
Tin:				
Ash and residue containing tin	--	42	--	All to Belgium-Luxembourg.
Metal including alloys, unwrought	40	29	--	Belgium-Luxembourg 24; Denmark 5.
Titanium: Oxides	21	--		
Zinc:				
Ore and concentrate	2,669	6,278	--	All to Italy.
Oxides	100	1,937	--	Norway 1,914; Switzerland 23.
Metal including alloys, unwrought	143	--		
Other:				
Ores and concentrates	20	--		
Ashes and residues	20,340	50,002	--	All to Norway.
Base metals including alloys, all forms	6,372	2	--	Japan 1; Sweden 1.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	3	--		
Artificial: Corundum	192	50	--	All to Spain.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$3	--		
Grinding and polishing wheels and stones	242	231	--	Italy 77; United Kingdom 42; Greece 24.
Asbestos, crude	--	6	--	All to Yugoslavia.

See footnotes at end of table.

Table 2.—German Democratic Republic: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p 2]	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Barite and witherite	653	210	--	Belgium-Luxembourg 100; Yugoslavia 100; Sweden 10.
Boron materials: Oxides and acids	--	14	--	Finland 7; Greece 7.
Bromine	1,024	536	--	France 357; Hungary 179.
Cement thousand tons	[5]1,557	[5]1,855	--	Sweden 106; Hungary 97; unspecified 1,443.
Chalk[5]	37,730	35,268	--	NA.
Clays, crude:				
Kaolin	[5]148,704	[5]137,876	--	Yugoslavia 13,883; Hungary 11,116; unspecified 91,522.
Unspecified	18,340	11,832	--	Netherlands 4,689; Hungary 4,424; Sweden 2,719.
Cryolite and chiolite	--	38	--	All to Norway.
Diamond:				
Gem, not set or strung value, thousands	$206	--		
Industrial stones do	$39	$432	--	All to Belgium-Luxembourg.
Feldspar, fluorspar, related materials:				
Fluorspar	25,831	11,926	--	Netherlands 9,157; Sweden 1,343; Belgium-Luxembourg 1,066.
Unspecified	3,508	7,100	--	Norway 4,752; Yugoslavia 1,246; Austria 1,102.
Fertilizer materials: Manufactured:				
Ammonia thousand tons	226	30	--	Spain 29; Sweden 1.
Nitrogenous do	[5]1,421	[5]2,186	290	Canada 67; France 67; unspecified 1,631.
Phosphatic do	8	10	--	France 4; Netherlands 3; Switzerland 1.
Potassic, K_2O content[5] do	2,791	2,814	38	Brazil 438; Czechoslovakia 407; India 303.
Unspecified and mixed do	118	93	6	Austria 79; Italy 6.
Graphite, natural	--	95	--	All to Yugoslavia.
Gypsum and plaster	[5]105,498	[5]97,812	--	Mainly to Sweden.
Kyanite and related materials	20	--		
Lime	55	--		
Magnesium compounds:				
Oxides and hydroxides	2,180	3,729	--	Austria 2,358; Sweden 900; Netherlands 381.
Other	11,251	94,003	--	Denmark 43,316; France 33,656; United Kingdom 8,904.
Nitrates, crude	40	118	--	Yugoslavia 100; Portugal 18.
Phosphates, crude	22,620	19,000	--	All to Bulgaria.
Pigments, mineral: Iron oxides and hydroxides, processed	384	158	--	Yugoslavia 90; United Kingdom 60; Sweden 8.
Potassium salts, crude	33,017	22,391	--	United Kingdom 13,810; Belgium-Luxembourg 8,581.
Precious and semiprecious stones other than diamond: Natural value, thousands	$74	$14	$13	Sweden $1.
Salt and brine[5] thousand tons	1,604	1,721	--	Sweden 90; Finland 54; unspecified 1,512.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	[5]327,100	[5]326,600	--	Czechoslovakia 82,000; Sweden 38,840; unspecified 128,904.
Sulfate, manufactured	18,542	3	--	All to Chile.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked thousand tons	29	2	--	Italy 1.
Worked do	29	(3)	--	Mainly to Norway.
Gravel and crushed rock[5] do	339	240	--	NA.
Limestone other than dimension do	58	--		
Quartz and quartzite do	3	(3)	--	All to Austria.
Sand other than metal-bearing do	44	35	--	Hungary 23; Austria 10; Yugoslavia 2.
Sand and gravel[5] do	2,246	1,893	--	All to West Germany.

See footnotes at end of table.

Table 2.—German Democratic Republic: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p 2]	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur:				
Elemental:				
Crude including native and byproduct	426	--		
Colloidal, precipitated, sublimed	2	--		
Dioxide	--	27	--	All to Belgium-Luxembourg.
Sulfuric acid	[5]22,965	[5]30,815	--	Czechoslovakia 5,011; Denmark 599; unspecified 25,205.
Talc, steatite, soapstone, pyrophyllite	68	--		
Other:				
Crude	92,778	15,375	--	Norway 10,903; Hungary 2,644; Austria 1,720.
Slag and dross, not metal-bearing	47,093	27,051	--	Finland 26,494; United Kingdom 531; Denmark 26.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	3,554	2,825	--	Czechoslovakia 1,129; Yugoslavia 283; Italy 228.
Coal:				
Anthracite and bituminous thousand tons	335	337	--	Poland 314; United Kingdom 23.
Briquets of anthracite and bituminous coal do.	13	3	--	Mainly to United Kingdom.
Lignite including briquets[5] do.	3,313	3,485	--	West Germany 1,208; Czechoslovakia 661; Austria 384.
Coke and semicoke do.	422	279	--	United Kingdom 106; Norway 55; Canada 38.
Gas, manufactured[5] million cubic feet	484	413	--	NA.
Peat including briquets and litter	2,594	45	--	Denmark 24; Austria 21.
Petroleum:				
Crude thousand 42-gallon barrels	--	([3])	--	All to Morocco.
Refinery products:				
Liquefied petroleum gas do.	720	67	--	Italy 46; Austria 19; Belgium-Luxembourg 2.
Gasoline do.	[5]6,178	[5]5,819	--	Sweden 326; France 20; unspecified 5,451.
Mineral jelly and wax do.	90	66	--	West Germany 21; Netherlands 9; Sweden 8.
Kerosene and jet fuel do.	97	122	--	Hungary 101; Sweden 20.
Distillate fuel oil do.	[5]4,550	[5]5,289	--	Mainly to Sweden.
Lubricants do.	[4]94	[4]42	3	Mainly to Austria.
Residual fuel oil do.	[4]29,138	[4]26,813	--	Denmark 1,728; Norway 1,663; unspecified 20,148.
Bitumen and other residues do.	523	1	--	Mainly to Austria.

[p]Preliminary. NA Not available.

[1]Table prepared by Jozef Plachy. Owing to a lack of official trade data published by the German Democratic Republic, this table should not be taken as a complete presentation of this country's mineral trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries.

[2]Totals for 1986 exclude imports by the Federal Republic of Germany.

[3]Less than 1/2 unit.

[4]Statistical Yearbook of Members of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

[5]Official Trade Statistics of the German Democratic Republic.

Table 3.—German Democratic Republic: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[p 2]	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	[3]208,400	[3]178,100	--	Hungary 140,460; Yugoslavia 3,716.
Oxides and hydroxides	70,677	27,822	--	Hungary 23,920; West Germany 3,869; France 24.
Ash and residue containing aluminum	--	18	--	All from United Kingdom.
Metal including alloys:				
Scrap	--	30	16	United Kingdom 14.
Unwrought	42,583	33,155	--	Yugoslavia 23,280; Hungary 8,625; France 1,013.
Semimanufactures	25,495	16,030	--	Hungary 8,286; Yugoslavia 6,981; Belgium-Luxembourg 406.
Antimony: Oxides	--	60	--	France 54; Netherlands 6.
Cadmium: Metal including alloys, all forms	38	184	--	All from Japan.
Chromium:				
Ore and concentrate, Cr_2O_3 content[3]	52,300	49,600	--	NA.
Oxides and hydroxides	34	53	--	All from United Kingdom.
Cobalt: Oxides and hydroxides	1	5	--	All from Netherlands.
Columbium and tantalum: Metal including alloys, tantalum	(4)	(4)	(4)	
Copper:				
Ore and concentrate	10,660	9,700	--	All from Morocco.
Oxides and hydroxides	--	2	--	All from Netherlands.
Ash and residue containing copper	--	51	--	All from Belgium-Luxembourg.
Metal including alloys:				
Scrap	5,851	4,027	--	Netherlands 1,406; Switzerland 1,018; Belgium-Luxembourg 962.
Unwrought	49,943	17,894	--	Chile 6,307; Poland 4,162; Belgium-Luxembourg 3,012.
Semimanufactures	13,253	1,220	1	Yugoslavia 1,054; France 59; Italy 25.
Gold: Metal including alloys, unwrought and partly wrought value, thousands	$169	$45	--	All from Netherlands.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite, Fe content[3] thousand tons	2,681	2,598	--	U.S.S.R. 1,472; India 452; Sweden 111.
Metal:				
Scrap do	886	986	--	U.S.S.R. 248; United Kingdom 213; France 72.
Pig iron, cast iron, related materials do	1,103	1,158	--	Italy 30; Spain 21; unspecified 1,106.
Ferroalloys:				
Ferrochromium	321	50	--	All from Netherlands.
Ferromanganese	75,000	74,000	--	NA.
Ferromolybdenum	4	2	--	All from United Kingdom.
Ferrosilicon	77	--		
Silicon metal	--	1	--	All from Yugoslavia.
Unspecified	12,598	5,948	--	France 110; Belgium-Luxembourg 91; unspecified 5,741.
Steel, primary forms thousand tons	111	107	--	Belgium-Luxembourg 20; France 5; unspecified 77.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	599	459	--	Mainly from U.S.S.R.
Universals, plates, sheets do	3,083	3,134	--	U.S.S.R. 509; Czechoslovakia 38; unspecified 2,544.
Hoop and strip do	152	145	--	NA.
Rails and accessories do	180	208	--	NA.
Wire do	28	26	--	West Germany 6; Belgium-Luxembourg 1; unspecified 17.
Tubes, pipes, fittings do	330	306	--	Yugoslavia 25; Czechoslovakia 22; unspecified 211.
Castings and forgings, rough do	6	9	--	Hungary 1; Yugoslavia 1; unspecified 7.

See footnotes at end of table.

Table 3.—German Democratic Republic: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p 2]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Lead:				
Oxides	18	9	--	All from Netherlands.
Ash and residue containing lead	--	219	--	United Kingdom 191; Belgium-Luxembourg 28.
Metal including alloys:				
Scrap	7,307	1,849	--	Netherlands 1,355; United Kingdom 389; Denmark 105.
Unwrought	7,179	8,231	--	Sweden 7,361; Italy 852; Netherlands 18.
Magnesium: Metal including alloys, unwrought	149	111	--	Yugoslavia 86; Italy 25.
Manganese:				
Ore and concentrate, metallurgical-grade, Mn content	[3]19,500	[3]30,200	--	Mainly from U.S.S.R.
Oxides	--	3	--	United Kingdom 2; Japan 1.
Mercury 76-pound flasks	1,044	--	--	
Molybdenum: Ore and concentrate	31	153	--	Belgium-Luxembourg 134; Netherlands 19.
Nickel:				
Matte and speiss, Ni content	631	--		
Oxides and hydroxides	1,028	--		
Ash and residue containing nickel	330	903	--	All from Belgium-Luxembourg.
Metal including alloys:				
Unwrought	245	186	--	Finland 180; Belgium-Luxembourg 6.
Semimanufactures	132	20	--	All from United Kingdom.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$13,290	$498	--	Italy $330; United Kingdom $167; Switzerland $1.
Silver: Metal including alloys, unwrought and partly wrought do	$102,818	$937	$24	United Kingdom $776; Italy $105; Switzerland $29.
Tin:				
Oxides	4,313	--		
Metal including alloys, semimanufactures	59	--		
Titanium:				
Ore and concentrate	1,840	1,775	--	All from Netherlands.
Oxides	13,556	7,064	73	Yugoslavia 4,545; Finland 2,446.
Metal including alloys, all forms	--	2	--	All from Japan.
Tungsten: Ore and concentrate	114	--		
Zinc:				
Ore and concentrate	85,571	8,764	--	All from Sweden.
Oxides	110	30	--	All from France.
Blue powder	79	--		
Ash and residue containing zinc	6,810	--		
Metal including alloys:				
Scrap	206	--		
Unwrought	21,998	7,652	--	Yugoslavia 5,209; Finland 1,300; Italy 592.
Semimanufactures	1,352	231	--	Norway 223; Austria 7; Yugoslavia 1.
Zirconium: Ore and concentrate	21	77	--	All from Netherlands.
Other:				
Ores and concentrates	96	1,804	--	All from Norway.
Oxides and hydroxides	63	16	--	United Kingdom 12; Netherlands 4.
Ashes and residues	10,484	3,165	--	Finland 1,935; Italy 847; Sweden 358.
Base metals including alloys, all forms	19,935	105	1	Finland 58; Sweden 46.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	71	5	--	All from Japan.
Artificial: Corundum	3,502	49	--	Do.
Dust and powder of precious and semi-precious stones including diamond value, thousands	$219	$21	--	Netherlands $17; Belgium-Luxembourg $4.
Grinding and polishing wheels and stones	358	226	--	Austria 206; France 8; Yugoslavia 5.
Asbestos, crude[3]	54,600	55,700	--	NA.
Barite and witherite	3,240	--		
Boron materials:				
Crude natural borates	180	--		
Oxides and acids	2,943	--		

See footnotes at end of table.

Table 3.—German Democratic Republic: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p 2]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Cement[5]	10,400	18,900	--	NA.
Chalk	633	214	--	All from France.
Clays, crude:				
Bentonite	5,267	6,232	--	All from Hungary.
Chamotte earth	123	224	--	All from Italy.
Fuller's earth	736	102	--	All from United Kingdom.
Kaolin	[3]1,400	[3]5,000	--	Czechoslovakia 1,000; United Kingdom 923; unspecified 3,077.
Unspecified	2,568	--		
Diamond:				
Gem, not set or strung value, thousands	$72	$120	--	All from Belgium-Luxembourg.
Industrial stones do	$2,207	$3,099	--	Belgium-Luxembourg $2,691; United Kingdom $360; Switzerland $48.
Diatomite and other infusorial earth	1,082	1,627	--	All from France.
Feldspar, fluorspar, related materials	3,886	13,606	--	Norway 9,506; Sweden 4,100.
Fertilizer materials:				
Crude, n.e.s	10	--		
Manufactured:				
Ammonia	17,590	--		
Nitrogenous, N_2 content	[5]7,000	[5]4,600	--	NA.
Phosphatic, P_2O_5 content	6,454	[5]33,200	--	Morocco 10,944; Tunisia 4,656; unspecified 17,600.
Unspecified and mixed	4,081	66,879	--	Austria 65,000; Sweden 1,879.
Graphite, natural[3]	6,634	5,289	--	NA.
Gypsum and plaster	58	5	--	Sweden 3; Austria 2.
Magnesium compounds	56,864	11,682	--	Czechoslovakia 11,156; Austria 526.
Mica, all forms[3]	1,124	1,212	--	India 568.
Phosphates, crude, P_2O_5 content[3] thousand tons	424	437	--	U.S.S.R. 333; Jordan 43.
Pigments, mineral:				
Natural, crude	73	--		
Iron oxides and hydroxides, processed	21	81	--	Belgium-Luxembourg 58; Spain 23.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$60	$4	--	All from United Kingdom.
Synthetic do	$56	--		
Salt and brine	10	--		
Sodium compounds, n.e.s.: Carbonate, manufactured	--	24	--	All from Yugoslavia.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	140	3,697	--	Hungary 2,756; Sweden 741; Italy 174.
Worked	324	275	--	All from Italy.
Gravel and crushed rock	305	293	--	Yugoslavia 266; Netherland 24; Austria 3.
Quartz and quartzite	8,411	--		
Sand other than metal-bearing	179	22	--	All from Italy.
Sulfur:				
Elemental, crude including native and byproduct	139,000	134,500	--	All from Poland.
Dioxide	3,981	--		
Sulfuric acid	[5]1,400	[5]18,500	--	Italy 6,300; unspecified 12,200.
Talc, steatite, soapstone, pyrophyllite	3,168	701	--	Austria 695; Belgium-Luxembourg 6.
Other:				
Crude	16,422	60	--	All from Austria.
Slag and dross, not metal-bearing	12,963	771	--	All from Sweden.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	584	5	--	Do.
Carbon black	44,805	28,312	--	U.S.S.R. 23,777; Sweden 2,559; France 1,550.
Coal:				
Anthracite and bituminous[3] thousand tons	5,098	7,014	--	U.S.S.R. 4,541; Czechoslovakia 784; Poland 642.
Lignite including briquets do	203	--		
Coke and semicoke[3] do	1,730	1,832	--	U.S.S.R. 991; Czechoslovakia 402; Poland 142.

See footnotes at end of table.

Table 3.—German Democratic Republic: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p 2]	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Gas, natural: Gaseous[3] million cubic feet	218,985	248,402	--	All from U.S.S.R.
Peat including briquets and litter	75	--		
Petroleum:				
Crude[3] thousand 42-gallon barrels	167,308	163,273	--	U.S.S.R. 125,442.
Refinery products:				
Liquefied petroleum gas do	142	--		
Gasoline do	110	85	--	Italy 58; Spain 26; Belgium-Luxembourg 1.
Mineral jelly and wax do	4	1	--	Mainly from Italy.
Kerosene and jet fuel do	59	3	--	All from Yugoslavia.
Distillate fuel oil do	538	(4)	--	Mainly from Sweden.
Lubricants[5] do	139	229	--	NA.
Residual fuel oil[5] do	167	170	--	NA.
Bitumen and other residues do	75	29	--	Yugoslavia 28.
Bituminous mixtures do	(4)	(4)	--	All from Sweden.
Petroleum coke do	148	--		
Unspecified do	6	--		

[p]Preliminary. NA Not available.

[1]Table prepared by Jozef Plachy. Owing to a lack of official trade data published by the German Democratic Republic, this table should not be taken as a complete presentation of this country's mineral trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries.

[2]Totals for 1986 exclude exports by the Federal Republic of Germany.

[3]Official Trade Statistics of the German Democratic Republic.

[4]Less than 1/2 unit.

[5]Statistical Yearbook of Members of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

COMMODITY REVIEW

The GDR mined small quantities of copper, iron, nickel, silver, tin, and uranium. Although metal mining in the GDR dates back to the Middle Ages, imports of concentrates, scrap, and finished metals have replaced the dwindling domestic reserves. The mining of industrial minerals and coal was more extensive, especially of lignite, potash, and rock salt, much of which was exported. Virtually all minerals, or 93% in 1983, were extracted by surface mining methods, 57.6% of which was lignite and 35.2% was building and various silicate materials.[8]

METALS

Aluminum.—Ore and concentrate were imported mostly from Hungary and Yugoslavia for domestic processing. The GDR published official production statistics for metallurgical-grade alumina only, although primary aluminum metal production was listed occasionally in national economic plans; it was 68,264 tons for 1986.[9] Almost one-half of the country's metal requirement was imported, mostly from Hungary and Yugoslavia. About 30% of the metal was exported, mostly to FRG. There were two operating aluminum smelters and one aluminum metal products plant.

Copper.—Copper-bearing shale was mined from two localities in the southeastern foothills of the Harz Mountains, the Sangerhausen ore district. Mining was underground at depths of 900 to 2,900 feet. Mining of copper shales around Mansfeld ceased in 1968. Reportedly, a 2,300-foot-deep ventilation shaft was sunk at Mansfeld, northeast of Sangerhausen. It was a part of the VEB Mansfeld Kombinat Wilhelm Pieck mine development program. Copper ore production was not reported by the GDR, but the 1987 national economic plan listed production at simply 48,000 tons, most likely a gross weight concentrate of perhaps 25% copper content.[10] Domestic mining continued to decline, and most of the metal production was based on imported materials and the recovery of scrap,

which was imported from various sources. The U.S.S.R. supplied the GDR with cathodes.

Iron and Steel.—The iron and steel industry was the mainstay of the GDR's heavy industry, ranking 20th in world production, just below the Republic of South Africa. The production continued to rise virtually uninterrupted from 3,207 tons in 1959 to its record level in 1987. This was not a small accomplishment because the Soviet Union supplied most of the iron ore requirements from the Krivoi Rog surface operations hundreds of miles away in the Ukraine. For all practical purposes, domestic extraction of iron ore ceased in 1970 because of unprofitability.

Three complexes, VEB Qualitats-und Edel-Stahlkombinat in Brandenburg, VEB Bandstahlkombinat "Hermann Mattern" (BHM) in Eisenhuttenstadt, and VEB Rohrkombinat Riesa in Riesa, produced raw steel in six steel works. A number of modernization and expansion projects were planned for startup in the new 5-year plan that starts in 1991. A new hot-strip mill at VEB Eisenhuttenkombinat Ost (EKO) of BHM was the major new project. EKO had no hot-rolling capacity. Slabs from the work's LD converter shop, built by Austria's Voestz-Alpine AG, were rolled at other works in the GDR, and in FRG, with hot coil returning to EKO for cold rolling. The U.S.S.R. was to assume the overall direction of the project, with some participation from FRG, Japan, and the United Kingdom.[11]

Lead and Zinc.—The GDR relied totally on imports for its lead and zinc requirements. Mining ceased in about 1978 due to poor grade and ore depletion. The larger refinery and two smelters were in Freiberg, and they were managed by the VEB Buntmetall lead-zinc-silver complex. The GDR's lead and zinc metal production was not reported, but the 1987 national economic plan listed 21,100 tons of zinc for the first time in many years, without any further clarification.

Nickel.—Mining of low-grade ore continued at small quantities. All production was from two small surface mines near St. Egidien in the southeast. Production statistics continued to be withheld. There were three operating smelters whose output was based mostly on imported materials.

Silver.—The mining of silver in the vicinity of Freiberg was over 800 years old in 1986.[12] It started in the Old Elizabeth Mine in 1168 and by some accounts ceased in 1969 because of unprofitability.[13] In addition to silver, lead and tin were also mined. The ore was extracted from thin veins, 15 to 30 centimeters in width, with 30° dips, and steeply dipping 2-meter-thick veins. The GDR also recycled metal scrap for the production of silver.

Tin.—Tin ore was mined at Altenberg and Ehrenfriedersdorf in the Erzgebirge area along the southeastern border, by VEB Bergbau-und Huttenkombinat Albert Funk. A stockwork was mined at Altenberg, whose center collapsed because of older underground workings. The mine was opened in 1440 to the depth of 150 meters, and was mining at a depth of 250 meters in the late 1980's. The ore was also extracted at the surface. The coarse-grained ore was beneficiated by gravity separation and the fine-grained by flotation methods. At Ehrenfriedersdorf, the ore was mined from steeply dipping 5-meter-thick beds at about 300-meter depths and beneficiated by gravity separation methods.[14] The production of tin was not reported in official statistics, but was listed as 2,400 tons in the 1986 national economic plan.[15]

INDUSTRIAL MATERIALS

Barite and Fluorspar.—All mining was underground from 0.5- to 3-meter-thick veins at 500-meter depths in the Harz Mountains and the Thuringian Forest areas in the southwestern part of the country. Barite was concentrated by flotation at the Lengenfeld plant. Reportedly, a new flotation method using new reagents was developed for alluvial spar concentration. The work was done by the Mining Academy of Freiberg in Karl-Marx-Stad, in cooperation with the VEB Kombinat Kali at Sonderhausen.

Clays (Kaolin).—Most of the GDR's kaolin deposits were in the southeastern part of the country, between Leipzig and Dresden. The largest deposits were at Brachwitz, Bortewitz, Caminau, Kemmlitz, Pommlitz, Querbitzsch, and Seilitz. VEB Vereinigte Kemmlitzer Kaolinwerke, the major producer, managed about 15 surface mines.

The ore grade continued to decline, requiring more overburden to be removed and stacked, resulting in higher costs and less production. The kaolin was used primarily by the ceramics industry.

Magnesium.—All of the GDR's magnesium was produced from magnesium-rich brines as a byproduct of potash mining and processing. VEB Kombinat Kali managed one plant at Sonderhausen and another at Teutschendal, at a combined approximate

capacity of 30,000 tons per year.[16]

Potash.—Potash was one of the few commodities that continued its steady expansion. After the U.S.S.R. and Canada, the GDR was the third largest producer, with about 12% of world output. It was also the third largest exporter of the material, after Canada and the U.S.S.R., and shipped about 17% of world exports. Kali Bergbau handled all foreign transactions for its parent company VEB Kombinat Kali. The Kombinat expanded its compaction and packing plant in 1980, so that about 24% of its potash was exported in granular form. The port of Wismar on the Baltic Sea was the main loading facility. Almost all of the potash produced was used as fertilizer by the domestic agriculture industry. Reportedly, Kalibetrieb Werra at Merkers improved its operation, which resulted in an additional 20,000 tons of material. The improved method was a crystallization process that reused effluent, which contained potash salts in solution from the operating potash plant.[17]

Salt.—The production of marine salt has remained more or less the same for the past 10 years and was officially reported. The mining of rock salt increased steadily, although not significantly, and production was not reported. Most of the rock salt came from the Bernburg underground mine; some of the salt was also extracted by solution mining from brines.

MINERAL FUELS

Lignite continued to contribute significantly to the GDR's economy, remaining its most important mining activity. The GDR also maintained its role as the world's largest producer of lignite. All mining was by surface methods; underground mining of anthracite ceased in 1978 because of complex geologic conditions. There were from 35 to 40 open pit mines, ranging from 100 to 200 feet in depth. Two new surface mines were reportedly put on-stream in 1987. Mining technology was inadequate for deeper mining and the quality of coal also decreased, especially the salt content. The high moisture content, at about 70%, may have caused a drop in lignite production during the severe 1986-87 winter because of freezing conditions. The demand for energy was still rising and energy conservation measures were in effect to counteract the difficult mining conditions and high cost of operations. Lignite reserves were estimated to last well into the next century, therefore remaining the GDR's only dependable domestic source of energy.

Although exploration for natural gas continued, this fuel constituted a small percentage of the available energy. Nuclear power also was an insignificant contributor of electricity, with only one plant operating. The GDR continued to rely on the U.S.S.R. for crude oil requirements.

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[1]Physical scientist, Division of International Minerals.

[2]CMEA is an organization of the following 10 centrally planned economy countries involved in economic cooperation and coordination: Bulgaria, Cuba, Czechoslovakia, the German Democratic Republic, Hungary, Mongolia, Poland, Romania, the U.S.S.R., and Vietnam. Yugoslavia has permanent observer status.

[3]The GDR mark (M) is not convertible, and the official exchange rate cannot be used as a measure of relative value. Foreign trade figures, however, are denoted in valuta marks (VM), which are convertible. The rate of valuta marks converted to U.S. dollars in 1987 was taken as VM1.82=US$1.00.

[4]Donovan, B. Honecker's Policy of Small Steps. Radio Free Europe Research, RAO Background Report 23 (German Democratic Republic). Feb. 17, 1988, p. 2.

[5]Neues Deutschland (East Berlin). Jan. 23-24, 1988, pp. 3-6.

[6]Staatlichen Zentralverwalturg fur Statistik Statistisches Jahrbuch 1987, der Deutschen Demokratischen Republik. Staatsverlag (East Berlin), 1987.

[7]Work cited in footnote 5.

[8]Strzodka, K. Der Bergbau der GDR und seine Folgelandschaft. Neue Bergbautechnik (Leipzig), No. 6, June 1987, p. 201.

[9]Neues Deutschland (East Berlin). Nov. 30-Dec. 2, 1985.

[10]———. Nov. 28, 1987, pp. 14-15.

[11]Metal Bulletin (London). Mar. 24, 1987, p. 19.

[12]Arnold, W. 800 Jahre Bergstadt Freiberg. Neue Bergbautechnik (Freiberg), No. 7, July 1986, pp. 247-251.

[13]Kozlovsky, E. A. (ed.). Gornaya entsiklopediya (Mining Encyclopedia). Sovetskaya entsiklopediya (Moscow), 1986, v. 2, p. 28.

[14]Work cited in footnote 13.

[15]Work cited in footnote 9.

[16]Coope, B. The World Magnesia Industry. Ind. Miner. (London), Feb. 1987, pp. 28-30.

[17]Mining Journal (London). Nov. 13, 1987, pp. 391-392.

The Mineral Industry of the Federal Republic of Germany

By George A. Rabchevsky[1]

The Federal Republic of Germany's (FRG) automobile industry suffered a sharp drop in new car sales early in 1987, and the steel industry faced further production cuts and plant closings because of poor export demand and strong competition. Because of impending production decreases, thousands of steel workers were planned to be laid off in North Rhine-Westphalia, causing workers' strikes. The coal industry was also hard hit by the appreciation of the deutsche mark, forcing the Government to increase subsidies and raise special coal taxes paid by the electricity consumers.

The FRG's real economic growth in the 1980's weakened considerably compared with the growth in the previous three decades. The gross national product (GNP) at $1,125.1 billion[2] was third largest among the market economy countries, exceeded only by the United States and Japan. In 1987, the GNP reportedly grew by only 1.7% in real terms, compared with 2.5% in 1986, and 2% in 1985. The weak U.S. dollar and bargain prices for oil and imported raw materials partly contributed to the slow growth of the economy.

The country's general economic conditions declined, especially in the north, where restructuring and/or closure of steel mills and mines resulted in decreased output and persistent unemployment, necessitating increasing subsidies to steel, coalmining, and shipbuilding industries. The south, on the other hand, continued to prosper, offering employment to displaced workers in the north. Although the unemployment situation decreased slightly in the FRG in comparison with previous years, the total number of unemployed remained virtually unchanged at 2.23 million workers. Moreover, the country's private sector had the highest employment costs in the world and the highest rate of taxation on corporate profits. Also, the unwillingness of workers to relocate or retrain contributed to the FRG's high public relief and taxation programs. Throughout the country, union workers from the North Rhine-Westphalia and the Ruhr Valley areas staged demonstrations and strikes to protest working conditions. The number of strikers affected included 2.5 million members of IG Metall, the metal workers' union, out of a total of about 3.9 million metal workers in the country. Workers' demands included a reduction of the 38-hour workweek to 36.5 hours. A metal worker in the FRG spent 1,669 working hours per year on the job, compared to Japan with 2,104 hours and the United States with 1,920 hours. The metals industry generated about 20% of the country's GNP.

North Rhine-Westphalia was the most industrialized state in the country. The chemical industry was the largest industrial sector, followed by machine tool and food processing industries. The iron and steel industry ranked fourth with a 1986 turnover of $18.4 billion, followed by automobile manufacturing and electroengineering. Coal mining was in seventh place with a turnover of $14.9 billion. About 33% of the 500 largest companies in the FRG were in North Rhine-Westphalia. Ten firms in the State ranked among the FRG's top 20 companies. The Ruhr Valley area to its south, on the other hand, was an economically depressed region, with low employment as a result of the coal and steel industry crises. Coal subsidies continued; only about 20% of FRG's coal mines were competitive.

A new law on venture-capital corporations, unternehmungs-beteiligungs-gesell-

schaften (UBGG), went into effect at the beginning of 1987. UBGG was designed to provide an entry to the stock market for medium-size enterprises. The first companies to take advantage of the new law were, reportedly, from the State of Bavaria in the south, where the last operating iron ore mine was shut down during the year.

PRODUCTION

The FRG has had a long history of mining and metals production, and it was relatively well endowed with certain mineral resources. However, changing world trade patterns and technologies altered traditional smokestack industries, resulting in declining production and mine closures. Instead, mining, minerals, and metals production industries have been largely replaced by the FRG's technology-intensive industries. Most major heavy industries, such as the steel and chemical industries, began in the late 1850's and eventually transformed themselves into high-technology manufacturers and materials processors. Total research and development expenditures in 1987 amounted to about $35 billion, or more than double the 1977 level. Research and development accounted for 2.5% of GNP, placing the FRG in second place behind Japan and ahead of the United States.[3] According to some analysts, many traditional metal markets were under attack from industrial minerals such as plastics, ceramics, and silica and carbon fibers, and the FRG metals industry sought new means to apply high technology in metals processing to stay competitive.[4] For example, Vereinigte Deutsche Metallwerke AG (VDM), the wholly owned subsidiary of Metallgesellschaft AG (MG), and Special Metals Corp. (SMC), a subsidiary of Astro-Tech International Inc. of the United States, agreed to cooperate in the European and U.S. markets. VDM and SMC planned to undertake joint research and development into various fields, such as special alloys or electronics applications.[5]

The FRG planned to drill the deepest hole in the world near Erbendorf in the Upper Palatinate, the State of Bavaria, as part of the International Lithosphere Program, at a cost of $273 million. The 14-kilometer deep hole would provide more data on the structure of the earth's crust, the possibilities of harnessing geothermal heat, and exploration for mineral deposits such as oil, gas, and ores. The deepest borehole to date is in the Kola Peninsula; it was drilled by the Soviet Union to a depth of 12.5 kilometers.

Table 1.—Federal Republic of Germany: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Bauxite, gross weight	359	343	275	410	400
Alumina thousand tons	1,580	1,701	1,657	1,560	1,320
Metal:					
Primary do	743	777	745	765	730
Secondary:					
Alloyed do	387	402	415	441	460
Unalloyed do	41	44	44	40	35
Cadmium metal, smelter	1,094	1,111	1,095	1,185	1,200
Copper:					
Mine output, Cu content	1,209	1,046	857	834	[2]1,483
Metal:					
Smelter:					
Primary	159,100	148,800	[r]152,400	161,900	161,000
Secondary	94,500	76,700	94,600	76,700	76,500
Total	253,600	225,500	247,000	238,600	237,500

See footnotes at end of table.

Table 1.—Federal Republic of Germany: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS —Continued					
Copper —Continued					
Metal —Continued					
Refined including secondary:					
Electrolytic	332,846	297,854	[r]330,034	339,052	[2]399,918
Fire-refined	87,928	[r]81,144	[r]84,131	82,948	--
Total	420,774	[e]378,998	[r]414,165	[r e]422,000	[2]399,918
Gold:[e]					
Mine output, Au content ... troy ounces	1,900	1,500	1,200	1,200	850
Metal including secondary ... do	350,000	350,000	350,000	350,000	350,000
Iron and steel:					
Iron ore and concentrate:					
Gross weight ... thousand tons	976	977	1,034	717	[2]247
Fe content ... do	279	293	309	212	[2]68
Metal:					
Pig iron ... do	26,598	30,203	31,531	29,018	[2]28,517
Blast furnace ferromanganese, spiegeleisen, ferrosilicon ... do	174	309	205	256	260
Ferroalloys, electric-furnace ... do	119	156	[r]171	206	185
Steel, crude ... do	35,729	39,389	40,497	37,134	[2]36,248
Semimanufactures ... do	26,061	27,957	28,919	27,540	[2]27,437
Lead:					
Mine output, Pb content	23,523	20,998	20,496	16,736	[2]18,844
Metal:					
Smelter:					
Primary	116,216	102,289	109,674	111,092	[2]113,601
Secondary	236,259	254,944	246,586	255,529	229,380
Total	352,475	357,233	356,260	366,621	[2]342,981
Refined:					
Primary	217,000	191,900	181,000	182,000	160,700
Secondary	135,500	165,300	175,300	184,500	[2]182,300
Total	352,500	357,200	356,300	366,600	[2]343,000
Mercury (secondary only) ... 76-pound flasks	2,005	--	--	--	--
Nickel metal including secondary[e] [3]	1,200	1,000	700	--	--
Platinum[e] ... troy ounces	2,450	2,000	2,200	1,800	2,000
Silver:					
Mine output, Ag content thousand troy ounces	1,167	1,225	1,090	884	[2]1,736
Metal including secondary[e] ... do	18,600	21,500	20,500	20,000	22,000
Tin metal including secondary[e]	[2]417	417	400	350	300
Zinc:					
Mine output:					
Zn content	113,500	113,100	117,600	103,706	[2]102,153
Zn content, recoverable	92,562	92,467	95,505	84,786	[2]80,542
Metal, unwrought, unalloyed:					
Primary	328,689	325,567	339,876	344,309	348,280
Secondary	27,848	30,825	27,887	26,622	[2]29,281
Total	356,537	356,392	367,763	370,931	[2]377,561
INDUSTRIAL MINERALS					
Abrasives: Artificial corundum	74,201	88,962	91,506	[e]92,000	90,000
Barite	163,965	166,568	171,269	201,565	185,000
Bromine	3,136	3,306	3,077	[e]2,500	2,500
Cement and clinker:					
Cement (excluding clinker) ... thousand tons	30,466	28,909	25,758	26,580	25,300
Clinker ... do	702	742	599	599	870
Clays:					
Fire clay excluding klebsand ... do	5,792	[e]5,800	5,384	5,534	5,500
Kaolin, marketable ... do	407	360	410	512	500
Bleaching ... do	601	628	1,595	1,319	1,300
Other (schieferton) ... do	75	69	75	80	75
Diatomite and similar earth, marketable	44,195	49,009	48,427	49,432	49,000
Feldspar, marketable	330,000	297,850	322,000	[e]305,000	300,000
Fluorspar, marketable:					
Acid-grade[e]	69,646	72,098	74,824	79,951	79,650
Metallurgical-grade[e]	11,064	11,170	8,314	8,883	8,850
Total	80,707	83,268	83,138	88,834	88,500

See footnotes at end of table.

Table 1.—Federal Republic of Germany: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Graphite:					
Crude	19,754	18,756	20,958	23,226	22,000
Marketable[4]	12,012	12,356	12,798	13,233	12,000
Gypsum and anhydrite, marketable thousand tons	1,721	2,485	2,262	2,367	1,900
Lime (hydrated), quicklime, dead-burned dolomite do	6,871	6,941	6,845	6,476	[2]6,111
Nitrogen: N content of ammonia do	1,703	1,963	1,908	1,570	[2]1,931
Phosphates: Thomas slag-based fertilizer, P_2O_5 content do	93	62	67	54	50
Pigments, mineral, natural	19,886	16,178	15,764	11,365	12,000
Potash, K_2O equivalent:					
Crude, marketable thousand tons	87	92	88	85	[2]84
Chemically processed do	2,332	2,553	2,495	2,076	[2]2,115
Total do	2,419	2,645	2,53	2,161	[2]2,199
Pumice:					
Crude and washed do	645	1,013	690	612	[2]580
Marketable do	200	355	207	215	205
Pyrites, marketable concentrate, gross weight do	554	514	512	471	200
Quartz, quartzite, glass sand:					
Quartzite do	331	362	346	339	[2]290
Quartz sand, ground do	337	316	304	317	[2]316
Quartz sand, unground and glass sand do	7,391	7,195	7,021	6,557	[2]6,128
Salt, marketable:					
Rock do	6,265	7,110	9,654	9,115	9,200
Marine and other do	4,603	5,102	3,426	3,987	4,000
Sodium compounds:					
Carbonate do	1,218	1,364	1,412	1,442	[2]1,448
Sulfate, synthetic do	125	128	139	163	165
Stone, sand and gravel:					
Dimension stone[5] thousand cubic meters	237	291	254	257	[2]264
Limestone, industrial thousand tons	44,371	43,505	40,403	40,267	[2]41,059
Crushed and broken stone do	91,445	97,439	94,072	101,189	[2]99,755
Slate do	62	23	28	[e]25	[2]22
Basalt lava and lava sand do	6,350	7,482	7,544	7,657	7,600
Calcite do	4	3	2	--	--
Grinding stone[e] cubic meters	40	42	40	40	45
Sand and gravel thousand tons	146,414	143,278	131,014	142,555	[2]137,050
Sulfur, byproduct:					
Of metallurgy[e] do	400	350	320	300	300
Of natural gas do	632	851	964	998	1,030
Of petroleum[e] do	195	190	200	190	210
Unspecified[e] do	95	90	85	85	85
Total do	1,322	1,481	1,569	1,573	1,625
Talc including talc schist do	14	17	21	22	21
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	362,125	382,420	387,134	383,666	[2]361,982
Coal:					
Anthracite and bituminous thousand tons	82,202	79,426	82,396	80,801	[2]76,300
Lignite do	124,281	126,739	120,667	114,310	[2]108,799
Total do	206,483	206,165	203,063	195,111	185,099
Coke, metallurgical do	22,427	20,586	22,331	22,254	[2]19,674
Fuel briquets:					
Of anthracite and bituminous coal do	1,244	1,437	1,511	1,199	[2]1,001
Of lignite do	3,568	3,818	4,068	3,630	[2]3,188
Gas:					
Manufactured (excluding that from petroleum refineries):[6]					
Blast furnace million cubic feet	145,917	174,345	176,641	159,795	[2]154,145
Coke oven do	185,858	174,345	187,588	190,025	[2]166,788
Natural, gross do	622,339	563,258	510,605	489,629	[2]560,468
Peat:					
Agricultural use thousand tons	1,868	1,429	1,516	2,017	[2]2,002
Fuel use do	259	277	284	246	[2]240

See footnotes at end of table.

Table 1.—Federal Republic of Germany: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum:					
Crude ------ thousand 42-gallon barrels	29,730	29,289	29,650	29,015	[2]27,447
Refinery products:					
Gasoline, motor ----------do----	170,885	170,629	[r]173,293	166,054	[2]160,072
Jet fuel (including aviation gasoline) ----------do----	11,231	13,318	13,797	14,140	[2]14,774
Kerosene ----------do----	356	295	[r]364	543	[2]550
Distillate fuel oil ----------do----	252,029	260,018	256,691	259,668	[2]242,517
Residual fuel oil ----------do----	104,649	92,701	[r]69,117	65,468	[2]58,355
Lubricants ----------do----	8,687	11,205	10,656	9,988	[2]9,961
Liquefied petroleum gas ----------do----	23,942	24,511	25,462	23,270	[2]24,963
Bitumen ----------do----	19,460	18,514	17,076	16,915	[2]16,259
Unspecified ----------do----	45,809	42,665	[r]52,299	46,576	4,904
Refinery fuel and losses ----------do----	50,169	48,769	46,557	46,403	[2]45,682
Total ----------do----	687,217	682,625	665,312	649,025	622,037

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 1988.
[2]Reported figure.
[3]Primary nickel and nickel contained in ferronickel, Monel metal, and nickel oxide directly used by the steel industry.
[4]Includes imported stock.
[5]Incomplete data.
[6]Other types of manufactured gas may be produced but production data are not reported, and available information is inadequate to make reliable estimates. Estimates presented in previous editions of this yearbook are considered unreliable.

TRADE

FRG's foreign-trade balance declined slightly, with imports rising while exports decreased because of low external demand. Nevertheless, FRG exported approximately one-third of its GNP, a share much higher than that of Japan or the United States. Exports in 1986, in terms of value, were the largest in the world, and most likely remained so in 1987. FRG's share of world trade in 1986 was about 11.3%, followed by the United States with 10.1%, and Japan, in third place, at 9.8%. However, only about 8.5% of FRG exports consisted of nonmanufactured goods, such as food products, semimanufactures, and raw materials. Over one-half of FRG's 1986 exports were to its 11 trading partners in the European Economic Community (EEC), France being its largest importer. Exports to the United States amounted to 10.5% of the total.

Direct foreign investment by the FRG had gradually increased from 1977 to 1987. In 1986, 30% of all direct foreign investments were made in the United States, representing an eightfold increase since 1976. The Government explained the trend by saying that only through increasing internationalization of its business can export-intensive firms hope to maintain and strengthen their market position. MG, a multifaceted mining and metals processing company, with international interests and one of the country's largest corporations, concentrated all of its international mining operations in a Toronto-based subsidiary, Metall Mining Corp. Ltd. (MMC). MMC filed a prospectus for a share issue to be made both in Canada and internationally. The new company was to acquire MG's international mining interests in Teck Cominco in Canada and in MIM Holdings Ltd. in Australia, as well as joint-venture participations in Australia, Canada, Papua New Guinea, and Turkey. MMC was expected to expand these interests. MG's action was part of a reorganization of all of its major mining activities. Its existing wholly owned subsidiary in Canada, Metallgesellschaft Canada Investments Ltd. (MCI), was incorporated into the new MMC.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkaline-earth metals	82	161	1	France 80; Belgium-Luxembourg 58; Netherlands 10.
Aluminum:				
Ore and concentrate	42,212	25,144	--	Belgium-Luxembourg 6,934; France 6,492; Austria 4,377.
Oxides and hydroxides	668,347	496,518	17,805	Austria 108,637; Canada 70,573; Italy 59,827.
Ash and residue containing aluminum	13,061	21,313	--	Finland 4,803; Netherlands 4,611; France 4,590.
Metal including alloys:				
Scrap	89,691	104,453	--	Italy 41,253; Netherlands 24,844; Belgium-Luxembourg 14,985.
Unwrought	281,694	300,882	890	France 74,714; Italy 51,197; Austria 47,998.
Semimanufactures	551,623	545,672	28,865	France 83,479; United Kingdom 78,989; Italy 54,927.
Antimony:				
Oxides	592	747	90	Switzerland 134; Belgium-Luxembourg 88.
Metal including alloys, all forms	104	53	(3)	Spain 19; Austria 12; United Kingdom 6.
Arsenic: Oxides and acids	367	219	(3)	United Kingdom 81; Italy 70; Yugoslavia 43.
Beryllium:				
Oxides and hydroxides	(3)	(3)	NA	NA.
Metal including alloys, all forms	(3)	(3)	(3)	Mainly to France.
Bismuth: Metal including alloys, all forms	251	77	2	United Kingdom 33; Italy 10.
Cadmium:				
Oxides and hydroxides	38	15	NA	NA.
Metal including alloys, all forms	296	438	NA	NA.
Cesium and rubidium: Metal including alloys, all forms	(3)	(3)	--	Mainly to Singapore.
Chromium:				
Ore and concentrate	8,909	12,061	--	France 3,904; Austria 1,983; Denmark 1,469.
Metal including alloys, all forms	126	133	20	United Kingdom 40; Belgium-Luxembourg 13.
Cobalt:				
Oxides and hydroxides	87	57	NA	Italy 21; Spain 13; Netherlands 10.
Metal including alloys, all forms	913	1,589	3	Italy 105; France 82; unspecified 1,236.
Columbium and tantalum:				
Ore and concentrate	1,895	54	NA	NA.
Ash and residue containing columbium or tantalum	2	327	268	Netherlands 56; Austria 3.
Metal including alloys, all forms:				
Columbium (niobium)	82	83	(3)	Japan 2; France 1; unspecified 76.
Tantalum	118	92	(3)	India 2; Japan 2; unspecified 87.
Copper:				
Ore and concentrate	47	--		
Matte and speiss including cement copper	627	828	--	Canada 481; Netherlands 326; Spain 21.
Oxides and hydroxides	2,379	2,317	55	United Kingdom 397; Denmark 308; Spain 224.
Sulfate	1,533	1,945	NA	NA.
Ash and residue containing copper	17,713	15,909	5	Austria 5,722; India 4,598; Belgium-Luxembourg 2,832.
Metal including alloys:				
Scrap	77,294	70,084	168	Netherlands 20,200; Italy 20,091; Belgium-Luxembourg 9,505.
Unwrought	105,582	68,561	231	France 14,526; United Kingdom 10,962; Sweden 9,416.
Semimanufactures	475,007	470,822	45,329	France 60,398; Italy 54,731.
Gallium: Metal including alloys, all forms	9	9	2	Japan 3; Switzerland 2.
Germanium: Metal including alloys, all forms	1	1	(3)	Mainly to Japan.
Gold:				
Ash and residue containing gold value, thousands	$1,592	$1,494	--	United Kingdom $954; Netherlands $539.
Waste and sweepings ---do---	$9,390	$1,087	$86	United Kingdom $382; Switzerland $268; Belgium-Luxembourg $238.
Metal including alloys, unwrought and partly wrought thousand troy ounces	1,496	2,109	555	Switzerland 640; United Kingdom 221.
Hafnium: Metal including alloys, all forms	(3)	(3)	--	All to Japan.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	2,576	4,591	--	France 1,824; Austria 1,210; Netherlands 896.
Pyrite, roasted	16,930	16,581	--	Belgium-Luxembourg 14,506; France 1,956; Austria 98.
Metal:				
Scrap thousand tons	3,632	3,418	(3)	Italy 1,704; Belgium-Luxembourg 610; Netherlands 388.
Pig iron, cast iron, related materials	722,367	527,598	574	France 320,803; Italy 67,552; Netherlands 46,392.
Ferroalloys:				
Ferrochromium	58,445	39,627	6,141	France 14,272; India 2,709.
Ferromanganese	65,808	68,851	22,781	France 10,367; Belgium-Luxembourg 8,386.
Ferromolybdenum	503	345	--	Belgium-Luxembourg 106; Sweden 58; Netherlands 50.
Ferronickel	2,023	797	--	Sweden 522; France 132; Netherlands 90.
Ferrosilicochromium	3,021	5,056	--	Belgium-Luxembourg 2,007; Italy 1,898; France 500.
Ferrosilicomanganese	3,682	4,002	--	Belgium-Luxembourg 905; Switzerland 800; Netherlands 718.
Ferrosilicon	69,445	65,549	695	Italy 13,280; France 11,149; Belgium-Luxembourg 8,468.
Silicon metal	9,606	7,820	438	Italy 1,803; Austria 1,706; France 1,326.
Unspecified	14,046	13,721	71	Italy 692; Sweden 480; unspecified 10,773.
Steel, primary forms thousand tons	5,207	4,182	52	France 471; Italy 454.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	3,336	2,905	188	France 620; Netherlands 478; Belgium-Luxembourg 214.
Universals, plates, sheets do	5,997	5,443	736	U.S.S.R. 809; France 481.
Hoop and strip do	1,382	1,305	43	France 187; Netherlands 154; Switzerland 138.
Rails and accessories do	259	172	25	Italy 46; Netherlands 23.
Wire do	322	301	23	France 63; Netherlands 50; Belgium-Luxembourg 39.
Tubes, pipes, fittings do	4,371	3,816	153	U.S.S.R. 1,326; China 363; Netherlands 357.
Castings and forgings, rough do	159	147	7	France 20; Belgium-Luxembourg 19; Austria 17.
Lead:				
Ore and concentrate	9,991	9,822	--	France 9,794; Netherlands 25; United Kingdom 2.
Oxides	9,656	19,050	NA	Netherlands 4,790; Sweden 2,835; Belgium-Luxembourg 2,811.
Ash and residue containing lead	18,937	11,193	NA	Belgium-Luxembourg 4,931; United Kingdom 3,935; France 1,460.
Metal including alloys:				
Scrap	14,558	11,496	--	Netherlands 10,516; Austria 389; Italy 276.
Unwrought	106,992	95,676	98	Italy 30,397; Austria 16,027; Denmark 8,757.
Semimanufactures	16,888	17,104	130	Denmark 4,527; Switzerland 1,433; unspecified 3,629.
Lithium:				
Oxides and hydroxides	761	694	--	Italy 175; United Kingdom 135; Netherlands 133.
Metal including alloys, all forms	71	54	(3)	Switzerland 36; Japan 7; France 4.
Magnesium: Metal including alloys:				
Scrap	1,665	1,370	429	Netherlands 368; Italy 264.
Unwrought	504	227	--	France 95; Belgium-Luxembourg 60; Austria 28.
Semimanufactures	1,296	1,071	2	Belgium-Luxembourg 341; France 90; Netherlands 87.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Manganese:				
Ore and concentrate, metallurgical-grade	1,144	1,000	23	Yugoslavia 466; France 253; Netherlands 70.
Oxides	972	808	NA	Belgium-Luxembourg 448; Italy 88; Yugoslavia 69.
Metal including alloys, all forms	118	193	5	Belgium-Luxembourg 59; United Kingdom 43; Yugoslavia 21.
Mercury 76-pound flasks	4,350	3,239	NA	Italy 592; France 403; Venezuela 174.
Molybdenum:				
Ore and concentrate	3,526	4,045	20	Netherlands 1,721; Austria 1,712; Belgium-Luxembourg 443.
Oxides and hydroxides	NA	1,191	94	Austria 794; Sweden 91.
Metal including alloys:				
Unwrought and scrap	603	598	NA	NA.
Semimanufactures	46	38	(3)	Brazil 12; Austria 7; Spain 3.
Nickel:				
Ore and concentrate	1	--		
Matte and speiss	1,491	1,727	--	Belgium-Luxembourg 1,273; Spain 182; Netherlands 159.
Oxides and hydroxides	58	98	--	Yugoslavia 48; Belgium-Luxembourg 18; Austria 12.
Ash and residue containing nickel	4,363	2,622	--	Austria 1,070; Belgium-Luxembourg 623; Netherlands 604.
Metal including alloys:				
Scrap	10,032	5,668	372	Sweden 4,245; Netherlands 573.
Unwrought	6,630	6,193	(3)	France 3,746; Netherlands 973; Belgium-Luxembourg 377.
Semimanufactures	14,099	12,294	3,535	France 1,362; Italy 936.
Platinum-group metals:				
Ash and residue containing platinum value, thousands	$623	$68	NA	Belgium-Luxembourg $56.
Waste and sweepings ---do---	$1,368	$2,501	--	United Kingdom $1,518; Spain $516; Netherlands $280.
Metals including alloys, unwrought and partly wrought:				
Palladium ---troy ounces---	187,215	156,843	22,570	United Kingdom 40,703; Switzerland 25,078.
Platinum ---do---	278,148	260,423	25,751	Switzerland 100,215; United Kingdom 21,033.
Unspecified ---do---	161,672	127,860	16,272	Japan 26,760; Netherlands 20,009.
Rare-earth metals including alloys, all forms	34	18	4	Japan 3; Italy 2.
Rhenium: Metal including alloys, all forms	(3)	(3)	--	Mainly to Yugoslavia.
Silver:				
Ash and residue containing silver value, thousands	$845	$1,633	NA	United Kingdom $989; Belgium-Luxembourg $457; Netherlands $106.
Waste and sweepings ---do---	$1,805	$2,165	$125	Belgium-Luxembourg $1,207; Netherlands $278; United Kingdom $222.
Metal including alloys, unwrought and partly wrought thousand troy ounces	47,772	31,158	726	Austria 3,118; Italy 2,997; Sweden 2,616.
Tellurium, elemental and arsenic	17	16	4	Austria 5; United Kingdom 4.
Tin:				
Ore and concentrate	110	138	--	Netherlands 80; Mexico 58.
Ash and residue containing tin	2,306	2,381	140	United Kingdom 1,992; Belgium-Luxembourg 189.
Metal including alloys:				
Scrap	87	123	--	Netherlands 83; Belgium-Luxembourg 22; United Kingdom 13.
Unwrought	3,788	3,468	503	United Kingdom 518; Netherlands 490.
Semimanufactures	1,519	1,276	6	Austria 191; Switzerland 147; unspecified 431.
Titanium:				
Ore and concentrate	15,076	5,064	2	Hungary 3,471; Bulgaria 398; France 351.
Oxides	71,021	56,106	15,398	Taiwan 5,079; Italy 4,124; Canada 3,733.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Titanium —Continued				
Metal including alloys:				
Scrap	811	644	80	United Kingdom 378; France 81.
Unwrought	56	50	17	Netherlands 15; Italy 5.
Semimanufactures	1,003	558	15	France 112; United Kingdom 65; Italy 60.
Tungsten:				
Ore and concentrate	2	--		
Oxides and hydroxides	NA	192	3	Austria 101; Japan 26; Romania 20.
Ash and residue containing tungsten	251	146	--	Austria 124; Netherlands 17; Belgium-Luxembourg 5.
Metal including alloys:				
Scrap	542	716	10	Austria 311; Sweden 279; Belgium-Luxembourg 45.
Unwrought	581	376	NA	NA.
Semimanufactures	199	150	4	Austria 16; Italy 15; France 14.
Uranium and thorium:				
Ore and concentrate	(3)	3,397	--	All to Czechoslovakia.
Oxides and other compounds	833	382	--	France 363; Belgium-Luxembourg 19.
Metal including alloys, all forms:				
Uranium	2	8	--	Canada 4; Italy 4.
Thorium	(3)	(3)	--	All to Greece.
Vanadium:				
Oxides and hydroxides	NA	700	NA	NA.
Ash and residue containing vanadium	4,296	2,735	--	Belgium-Luxembourg 2,475; Italy 199; United Kingdom 36.
Metal including alloys:				
Scrap	--	(3)	--	All to Japan.
Unwrought	393	209	(3)	United Kingdom 109; Japan 61; France 36.
Semimanufactures	(3)	(3)	--	All to Bulgaria.
Zinc:				
Ore and concentrate	203,876	96,609	--	Netherlands 32,992; Belgium-Luxembourg 29,020; France 26,563.
Oxides	17,128	22,794	NA	NA.
Blue powder	8,050	6,929	NA	Netherlands 1,335; Switzerland 1,061; United Kingdom 1,003.
Matte	12,657	6,994	--	Italy 2,798; Netherlands 2,324; Belgium-Luxembourg 555.
Ash and residue containing zinc	81,577	77,492	--	Sweden 31,617; Belgium-Luxembourg 16,685; United Kingdom 8,658.
Metal including alloys:				
Scrap	16,181	18,328	--	Netherlands 6,826; Italy 2,115; unspecified 6,872.
Unwrought	133,156	102,202	1,001	Italy 27,158; France 21,172; Belgium-Luxembourg 11,124.
Semimanufactures	22,511	21,060	NA	NA.
Zirconium:				
Ore and concentrate	15,051	15,621	--	Poland 2,542; France 2,500; Czechoslovakia 1,908.
Metal including alloys:				
Scrap	42	82	19	France 35; United Kingdom 22.
Unwrought	25	16	1	Netherlands 4; Sweden 4; United Kingdom 2.
Semimanufactures	21	6	(3)	Austria 2; Switzerland 2; France 1.
Other:				
Ores and concentrates	47	--		
Oxides and hydroxides	6,801	710	3	Italy 250; Czechoslovakia 107; Spain 101.
Ashes and residues	147,027	122,343	119	Belgium-Luxembourg 63,169; France 52,698; Netherlands 4,131.
Base metals including alloys, all forms	19,993	246	10	Romania 92; Belgium-Luxembourg 40; United Kingdom 34.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	364,412	303,545	73	Netherlands 281,508; Switzerland 9,199; Belgium-Luxembourg 9,018.
Artificial:				
Corundum	58,757	54,996	3,253	Italy 7,861; France 5,634; United Kingdom 5,438.
Silicon carbide	33,373	27,074	NA	NA.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Abrasives, n.e.s. —Continued				
Dust and powder of precious and semi-precious stones including diamond kilograms	1,944	8,094	156	Switzerland 2,536; France 1,371; Greece 1,326.
Grinding and polishing wheels and stones	17,334	17,398	1,387	France 2,151; Netherlands 1,478; United Kingdom 1,242.
Asbestos, crude	3,065	777	NA	NA.
Barite and witherite	55,988	38,822	311	France 10,742; Belgium-Luxembourg 7,171; Sweden 6,243.
Boron materials:				
Crude natural borates	5,895	2,201	--	Sweden 2,016; Yugoslavia 70; Belgium-Luxembourg 32.
Elemental	11	11	5	France 3; Sweden 1.
Oxides and acids	794	564	NA	Czechslovakia 91; Yugoslavia 65; Colombia 42.
Bromine	6	3	(3)	Republic of South Africa 1.
Cement thousand tons	2,189	2,079	1	Netherlands 1,580; Belgium-Luxembourg 111; Nigeria 99.
Chalk	88,270	81,843	65	Finland 44,940; Netherlands 15,086; Sweden 9,971.
Clays, crude:				
Bentonite	34,444	32,943	19	Belgium-Luxembourg 8,442; France 7,122; Austria 5,933.
Ceramic	1,170,660	1,294,775	NA	Italy 795,660; France 177,009; Netherlands 158,993.
Chamotte earth	27,540	29,364	--	Netherlands 12,865; Austria 3,903; Italy 3,605.
Fire clay	183,388	154,576	NA	Netherlands 89,562; Italy 22,239; Austria 17,490.
Fuller's earth	4,118	3,867	--	France 1,183; Belgium-Luxembourg 694; United Kingdom 194.
Kaolin	104,302	117,176	72	Italy 29,488; Austria 18,085; Switzerland 17,617.
Unspecified	r258,032	499,548	NA	Netherlands 335,785; Belgium-Luxembourg 106,522; France 24,259.
Cryolite and chiolite	298	182	--	Italy 174; Denmark 4; Greece 3.
Diamond:				
Gem, not set or strung carats	127,319	174,279	5,961	Belgium-Luxembourg 54,085; United Kingdom 30,328; Switzerland 21,988.
Industrial stones do	452,387	236,027	55,168	Ireland 75,516; Switzerland 23,729.
Diatomite and other infusorial earth	1,510	1,247	7	France 304; Belgium-Luxembourg 171; Austria 148.
Feldspar, fluorspar, related materials:				
Feldspar	20,313	26,313	33	France 13,206; Netherlands 5,404; Belgium-Luxembourg 3,679.
Fluorspar	15,833	13,100	23	Austria 6,676; France 3,585; Belgium-Luxembourg 698.
Unspecified	1,190	644	14	Belgium-Luxembourg 476; Netherlands 96; Austria 26.
Fertilizer materials:				
Crude, n.e.s	110,774	107,895	--	Netherlands 91,603; Switzerland 4,164; Italy 2,954.
Manufactured:				
Ammonia thousand tons	334	202	NA	Denmark 110; Norway 18; Sweden 14.
Nitrogenous do	1,541	1,450	2	Belgium-Luxembourg 418; Netherlands 267; France 133.
Phosphatic do	114	86	--	Netherlands 33; Austria 26; France 14.
Potassic do	2,333	2,177	58	Belgium-Luxembourg 503; India 260; Ireland 145.
Unspecified and mixed do	862	960	(3)	Belgium-Luxembourg 317; France 97; Italy 89.
Graphite, natural	11,522	9,130	511	Italy 1,675; Spain 932; Austria 741.
Gypsum and plaster	274,615	279,902	--	Netherlands 85,369; Belgium-Luxembourg 50,937; Switzerland 38,706.
Iodine	64	47	(3)	United Kingdom 8; Denmark 7; Italy 6.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Kyanite and related materials	8,013	7,470	393	Austria 1,327; France 1,307; United Kingdom 890.
Lime	421,442	459,687	--	Netherlands 283,829; France 66,675; Switzerland 42,914.
Magnesium compounds:				
Magnesite, crude	24	22	--	Belgium-Luxembourg 15; Australia 5; France 1.
Oxides and hydroxides	30,271	39,694	387	France 22,967; Italy 2,763; Netherlands 2,483.
Other	444,732	371,813	15,315	France 85,122; Norway 42,337; Belgium-Luxembourg 34,228.
Mica:				
Crude including splittings and waste	1,447	1,365	34	Netherlands 325; Spain 206; Yugoslavia 135.
Worked including agglomerated splittings	220	283	3	Italy 68; United Kingdom 46; Hong Kong 41.
Phosphates, crude	9,824	2,482	--	Switzerland 1,727; Belgium-Luxembourg 390; Netherlands 304.
Phosphorus, elemental	2,299	NA		
Pigments, mineral:				
Natural, crude	1,598	1,158	506	Switzerland 503; France 64.
Iron oxides and hydroxides, processed	166,495	143,698	NA	NA.
Potassium salts, crude	50,006	43,401	--	Belgium-Luxembourg 20,936; United Kingdom 17,780; Netherlands 3,339.
Precious and semiprecious stones other than diamond:				
Natural	338	302	18	China 88; Hong Kong 47; India 37.
Synthetic	20	45	3	Japan 14; Switzerland 9; Italy 3.
Pyrite, unroasted	1,217	1,290	NA	NA.
Quartz crystal, piezoelectric kilograms	183	147	NA	France 30.
Salt and brine thousand tons	2,360	2,291	(3)	Belgium-Luxembourg 1,405; Sweden 333; United Kingdom 120.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	407,343	432,075	28	Belgium-Luxembourg 231,474; Netherlands 48,131; Sweden 25,752.
Sulfate, manufactured	73,104	74,306	NA	Italy 19,971; Netherlands 16,387; Switzerland 10,015.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked thousand tons	691	637	(3)	Netherlands 533; Switzerland 60; Italy 11.
Worked do	41	46	1	Austria 10; Belgium-Luxembourg 8; Switzerland 8.
Dolomite, chiefly refractory-grade do	112	103	(3)	Netherlands 29; Belgium-Luxembourg 24; France 13.
Gravel and crushed rock do	8,965	11,269	(3)	Netherlands 8,820; Switzerland 1,412; Belgium-Luxembourg 654.
Limestone other than dimension do	86	86	(3)	Netherlands 74; Belgium-Luxembourg 8; Switzerland 2.
Quartz and quartzite do	90	56	(3)	Austria 14; Belgium-Luxembourg 10; Italy 9.
Sand other than metal-bearing do	6,358	7,503	(3)	Netherlands 5,362; Belgium-Luxembourg 1,231; Switzerland 546.
Sulfur:				
Elemental:				
Crude including native and byproduct	671,952	686,040	22	Netherlands 297,992; Switzerland 45,593; Denmark 42,842.
Colloidal, precipitated, sublimed	502	361	NA	Belgium-Luxembourg 217; France 38.
Dioxide	27,899	22,373	--	Austria 10,303; Netherlands 6,653; Belgium-Luxembourg 3,057.
Sulfuric acid	660,988	732,863	55,955	Netherlands 231,435; Belgium-Luxembourg 208,042; United Kingdom 117,753.
Talc, steatite, soapstone, pyrophyllite	8,534	7,397	5	Netherlands 4,387; Yugoslavia 1,126; Switzerland 388.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Vermiculite, perlite, chlorite	6,885	7,318	35	Belgium-Luxembourg 4,210; Netherlands 1,685; Switzerland 801.
Other:				
Crude thousand tons	2,115	2,189	(3)	Netherlands 1,600; Belgium-Luxembourg 310; France 150.
Slag and dross, not metal-bearing do	3,593	4,038	12	Netherlands 2,904; France 915; Belgium-Luxembourg 79.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	6,228	5,431	--	Austria 2,269; Belgium-Luxembourg 1,592; Sweden 593.
Carbon:				
Carbon black	31,211	6,374	465	United Kingdom 908; Austria 885; France 867.
Gas carbon	126,934	122,519	2,102	France 40,405; Austria 16,845; Belgium-Luxembourg 9,682.
Coal:				
Anthracite and bituminous thousand tons	8,957	6,701	--	France 2,245; Belgium-Luxembourg 1,582; Italy 1,776.
Briquets of anthracite and bituminous coal do	668	475	--	United Kingdom 202; France 115; Belgium-Luxembourg 80.
Lignite including briquets do	1,074	924	--	Belgium-Luxembourg 298; Austria 212; Netherlands 112.
Coke and semicoke do	5,504	3,391	(3)	Belgium-Luxembourg 1,560; France 832; Netherlands 187.
Gas, natural: Gaseous million cubic feet	256,358	48,795	--	NA.
Peat including briquets and litter thousand tons	1,066	1,249	(3)	Netherlands 690; France 184; Italy 90.
Petroleum:				
Crude thousand 42-gallon barrels	8,805	(3)	--	Mainly to Netherlands.
Refinery products:				
Liquefied petroleum gas do	5,655	4,874	--	Netherlands 2,266; Italy 1,056; Austria 456.
Gasoline do	12,240	9,364	168	Switzerland 4,365; Austria 1,339; Netherlands 1,275.
Mineral jelly and wax do	1,385	1,412	--	Netherlands 236; Republic of South Africa 114; Belgium-Luxembourg 82.
Kerosene and jet fuel do	10,674	10,808	161	Switzerland 238; Netherlands 204; bunkers 10,028.
Distillate fuel oil do	8,760	6,858	2	Switzerland 3,029; France 1,171; Austria 648.
Lubricants do	3,873	3,122	24	Belgium-Luxembourg 459; United Kingdom 391; Sweden 240.
Residual fuel oil do	15,640	13,311	--	Austria 2,670; Belgium-Luxembourg 1,644; bunkers 6,121.
Bitumen and other residues do	2,760	2,849	(3)	Austria 749; Switzerland 714; Denmark 388.
Bituminous mixtures do	126	137	(3)	Netherlands 40; Switzerland 32; Austria 18.
Petroleum coke do	2,157	1,585	--	France 358; Netherlands 327; Austria 316.
Unspecified do	6	--		

[r]Revised. NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Excludes trade with East Germany.
[3]Less than 1/2 unit.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	1,374	1,877	(3)	France 858; Netherlands 3; unspecified 1,015.
Alkaline-earth metals	547	544	15	France 209; U.S.S.R. 150; China 67.
Aluminum:				
Ore and concentrate thousand tons	4,034	3,659	(3)	Australia 1,287; Guinea 1,108; Sierra Leone 867.
Oxides and hydroxides	664,738	721,698	3,021	Australia 266,771; Italy 170,972; Ireland 122,308.
Ash and residue containing aluminum	74,629	46,234	18	Netherlands 10,522; U.S.S.R. 7,217; Austria 5,521.
Metal including alloys:				
Scrap	202,882	215,151	4,813	Netherlands 49,854; United Kingdom 43,664; France 25,162.
Unwrought	721,618	764,332	6,863	Norway 227,764; United Kingdom 65,673; Netherlands 62,959.
Semimanufactures	331,329	345,138	2,024	France 79,960; Belgium-Luxembourg 49,560; Netherlands 48,367.
Antimony:				
Ore and concentrate	1,630	1,845	--	China 1,010; Bolivia 805; Chile 30.
Oxides	4,806	4,581	44	Belgium-Luxembourg 1,313; France 1,134; China 1,102.
Metal including alloys, all forms	783	977	5	China 341; Turkey 300; U.S.S.R. 157.
Arsenic: Oxides and acids	328	345	--	Belgium-Luxembourg 205; France 98; Sweden 19.
Beryllium:				
Oxides and hydroxides	(3)	(3)	--	Mainly from United Kingdom.
Metal including alloys, all forms	2	5	2	United Kingdom 3.
Bismuth: Metal including alloys, all forms	385	434	2	Peru 72; United Kingdom 58; Japan 27.
Cadmium:				
Oxides and hydroxides	532	556	--	Belgium-Luxembourg 512; France 32.
Metal including alloys, all forms	546	531	(3)	Belgium-Luxembourg 127; Netherlands 100; Canada 65.
Cesium and rubidium: Metal including alloys, all forms	(3)	(3)	(3)	
Chromium:				
Ore and concentrate	384,473	275,307	--	Republic of South Africa 188,452; Turkey 39,068; Albania 23,022.
Oxides and hydroxides	1,893	2,744	19	China 1,511; Poland 382; United Kingdom 243.
Metal including alloys, all forms	1,460	1,180	44	United Kingdom 375; France 291; Japan 214.
Cobalt:				
Ore and concentrate	5	--	--	
Oxides and hydroxides	441	374	1	Belgium-Luxembourg 188; Finland 106; United Kingdom 42.
Metal including alloys, all forms	2,122	2,849	57	Zaire 1,788; Zambia 321; Canada 184.
Columbium and tantalum:				
Ore and concentrate	506	1,089	NA	NA.
Ash and residue containing columbium and/or tantalum	3,998	2,078	143	Thailand 687; Zimbabwe 421; Spain 359.
Metal including alloys, all forms:				
Columbium (niobium)	34	24	21	Japan 1.
Tantalum	173	148	107	Austria 9; Belgium-Luxembourg 9.
Copper:				
Ore and concentrate	549,081	581,423	5,320	Papua New Guinea 213,097; Mexico 128,000; Chile 86,098.
Matte and speiss including cement copper	7,086	8,543	--	Spain 4,020; France 2,995; Cyprus 720.
Oxides and hydroxides	1,310	1,585	58	Belgium-Luxembourg 811; Italy 643.
Sulfate	10,215	10,474	2	Belgium-Luxembourg 1,887; France 1,672; Poland 1,605.
Ash and residue containing copper	25,141	19,378	735	Italy 4,354; Switzerland 3,177; Netherlands 3,118.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Copper —Continued				
Metal including alloys:				
Scrap	269,855	248,067	19,110	United Kingdom 47,272; France 45,044; Netherlands 34,467.
Unwrought	562,045	545,829	5,656	Chile 135,506; Poland 85,061; Zaire 78,289.
Semimanufactures	300,088	270,488	1,149	Belgium-Luxembourg 98,902; France 76,718; Italy 22,747.
Gallium: Metal including alloys, all forms	17	14	5	Belgium-Luxembourg 3; France 3.
Germanium: Metal including alloys, all forms	6	13	(3)	China 5; United Kingdom 4; Belgium-Luxembourg 3..
Gold:				
Ash and residue containing gold value, thousands	$13,349	$21,942	$15,656	Switzerland $2,578; Chile $1,370.
Waste and sweepings do	$26,744	$54,312	--	Singapore $7,179; Sweden $5,021; Belgium-Luxembourg $3,711.
Metal including alloys, unwrought and partly wrought thousand troy ounces	2,673	3,225	8	United Kingdom 537; Republic of South Africa 514; Switzerland 335.
Hafnium: Metal including alloys, all forms	(3)	1	(3)	Mainly from France.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	45,007	41,632	(3)	Brazil 15,640; Canada 6,414; Liberia 5,930.
Pyrite, roasted do	76	78	--	Belgium-Luxembourg 33; Sweden 28; Norway 16.
Metal:				
Scrap do	1,836	1,376	9	Netherlands 414; France 262; United Kingdom 167.
Pig iron, cast iron, related materials	268,929	327,593	325	Brazil 104,702; Canada 77,176; France 33,948.
Ferroalloys:				
Ferrochromium	287,300	272,458	19	Republic of South Africa 145,615; Zimbabwe 34,313; Netherlands 27,225.
Ferromanganese	129,854	106,140	409	France 46,526; Norway 28,911; Republic of South Africa 13,520.
Ferromolybdenum	5,795	5,769	56	Belgium-Luxembourg 2,457; United Kingdom 1,413; Netherlands 687.
Ferronickel	101,491	88,157	28	Greece 38,555; New Caledonia 22,079; Dominican Republic 6,487.
Ferrosilicochromium	17,793	16,545	--	Zimbabwe 14,248; Sweden 1,857; Italy 94.
Ferrosilicomanganese	123,253	111,817	3,044	Norway 55,326; Republic of South Africa 19,995; Czechoslovakia 10,531.
Ferrosilicon	220,079	206,340	2,096	Norway 98,675; France 21,208; Yugoslavia 7,182.
Silicon metal	68,842	66,791	2	Norway 28,528; France 10,347; Switzerland 5,692.
Unspecified	18,957	17,767	62	France 4,161; Brazil 2,884; United Kingdom 2,148.
Steel, primary forms thousand tons	2,403	2,017	6	Belgium-Luxembourg 627; Netherlands 262; United Kingdom 242.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	4,019	4,159	4	Italy 845; Belgium-Luxembourg 766; France 538.
Universals, plates, sheets do	3,895	4,005	4	Belgium-Luxembourg 992; France 730; Austria 394.
Hoop and strip do	663	701	1	Belgium-Luxembourg 257; France 178; Austria 67.
Rails and accessories do	17	14	(3)	Netherlands 5; Poland 3; Austria 2.
Wire do	311	309	(3)	Belgium-Luxembourg 91; France 56; Italy 39.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures —Continued				
Tubes, pipes, fittings thousand tons	976	987	1	Italy 274; France 149; Netherlands 114.
Castings and forgings, rough do	72	57	(3)	France 9; Netherlands 7; Denmark 6.
Lead:				
Ore and concentrate	236,490	194,054	--	Sweden 35,011; Canada 34,406; Australia 30,150.
Oxides	9,212	10,577	18	Belgium-Luxembourg 4,149; United Kingdom 1,947; France 325.
Ash and residue containing lead	45,133	30,483	823	Australia 11,353; France 8,990; Tunisia 2,612.
Metal including alloys:				
Scrap	45,905	50,542	30	Czechoslovakia 8,625; Denmark 8,297; Netherlands 6,501.
Unwrought	135,139	143,420	5,543	United Kingdom 56,655; Belgium-Luxembourg 19,279; Netherlands 16,298.
Semimanufactures	3,705	4,307	15	Belgium-Luxembourg 3,167; United Kingdom 547; Netherlands 285.
Lithium:				
Oxides and hydroxides	687	1,668	311	Switzerland 886; China 238.
Metal including alloys, all forms	22	24	2	United Kingdom 17; France 2; Hungary 2.
Magnesium: Metal including alloys:				
Scrap	3,901	5,229	80	Belgium-Luxembourg 1,956; Netherlands 772; Sweden 437.
Unwrought	26,944	27,710	5,034	Norway 15,882; France 2,496.
Semimanufactures	1,634	3,261	96	Austria 1,438; Turkey 822; Belgium-Luxembourg 521.
Manganese:				
Ore and concentrate, metallurgical-grade	377,795	473,126	--	Republic of South Africa 235,376; Australia 131,915; Brazil 47,876.
Oxides	5,601	5,261	9	Japan 2,315; Belgium-Luxembourg 1,953; Greece 519.
Metal including alloys, all forms	6,225	6,343	403	Republic of South Africa 3,311; Belgium-Luxembourg 997; France 852.
Mercury 76-pound flasks	11,687	11,960	NA	Spain 4,814; Algeria 3,103; U.S.S.R. 1,827.
Molybdenum:				
Ore and concentrate	17,600	17,817	3,131	Chile 4,523; Belgium-Luxembourg 3,844.
Oxides and hydroxides	174	120	23	Netherlands 26; Chile 13.
Metal including alloys:				
Scrap	472	553	52	Austria 331; United Kingdom 41.
Unwrought	270	119	37	United Kingdom 40; France 35.
Semimanufactures	403	360	107	Austria 207; United Kingdom 17.
Nickel:				
Ore and concentrate	24	5	--	All from Belgium-Luxembourg.
Matte and speiss	12,583	11,186	--	Australia 10,571; Canada 565; Cuba 50.
Oxides and hydroxides	234	558	(3)	Australia 317; Canada 115; Netherlands 39.
Ash and residue containing nickel	2,099	1,702	55	Belgium-Luxembourg 415; Netherlands 397; United Kingdom 141.
Metal including alloys:				
Scrap	7,561	6,062	1,756	France 1,817; Netherlands 663.
Unwrought	42,368	47,148	733	U.S.S.R. 15,469; Norway 5,880; Canada 5,686.
Semimanufactures	8,766	6,919	721	France 3,209; United Kingdom 1,442.
Platinum-group metals:				
Ash and residue containing platinum value, thousands	$7,927	$10,928	$5,022	United Kingdom $1,504; Finland $1,180.
Waste and sweepings do	$31,684	$46,955	$3,802	Netherlands $9,831; Belgium-Luxembourg $6,590; Hungary $4,078.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Platinum-group metals —Continued				
Metals including alloys, unwrought and partly wrought:				
Palladium ——— troy ounces	621,575	582,222	45,494	U.S.S.R. 222,614; United Kingdom 133,394; Czechoslovakia 60,958.
Platinum ——— do	621,222	570,680	41,236	Switzerland 150,242; United Kingdom 135,677; Republic of South Africa 63,241.
Unspecified ——— do	155,632	174,387	59,639	Republic of South Africa 59,335; United Kingdom 32,950.
Rare-earth metals including alloys, all forms	107	113	4	Austria 77; United Kingdom 13; Brazil 10.
Rhenium: Metal including alloys, all forms	(3)	(3)	NA	Mainly from U.S.S.R.
Selenium, elemental and phosphorus	28,468	25,384	NA	NA.
Silicon, high-purity	44	31	2	United Kingdom 9; Sweden 7; France 6.
Silver:				
Ash and residue containing silver value, thousands	$62,604	$49,935	$31,442	Canada $4,476; Chile $2,688.
Waste and sweepings ——— do	$30,315	$24,475	$13,174	Netherlands $2,251; Mexico $1,866.
Metal including alloys, unwrought and partly wrought thousand troy ounces	35,442	42,303	3,094	United Kingdom 14,433; Sweden 4,592; Switzerland 4,503.
Tellurium, elemental and arsenic	74	103	(3)	Sweden 24; United Kingdom 24; Belgium-Luxembourg 21.
Tin:				
Ore and concentrate	2,351	504	--	Bolivia 415; Zaire 72; United Kingdom 10.
Oxides	42	41	1	United Kingdom 32; Italy 5; Netherlands 3.
Ash and residue containing tin	8,247	4,874	1,468	Netherlands 1,227; United Kingdom 943.
Metal including alloys:				
Scrap	224	303	16	Netherlands 107; United Kingdom 41; Austria 40.
Unwrought	19,138	18,825	188	Indonesia 3,403; United Kingdom 2,563; Thailand 2,297.
Semimanufactures	194	62	1	United Kingdom 30; Netherlands 14; Norway 5.
Titanium:				
Ore and concentrate	486,362	450,604	18	Norway 257,157; Netherlands 71,658; Sri Lanka 39,471.
Oxides	16,980	17,806	1,312	Belgium-Luxembourg 6,300; France 4,909; United Kingdom 2,555.
Metal including alloys:				
Scrap	886	555	61	Japan 321; United Kingdom 69.
Unwrought	2,269	1,609	309	Japan 857; U.S.S.R. 423.
Semimanufactures	836	738	197	Japan 244; United Kingdom 221.
Tungsten:				
Ore and concentrate	3,843	3,184	2	Canada 696; China 675; Sweden 393.
Oxides and hydroxides	3	32	1	China 30.
Ash and residue containing tungsten	803	337	42	Sweden 105; United Kingdom 95; Netherlands 48.
Metal including alloys:				
Scrap	483	486	15	Austria 103; France 84; Netherlands 58.
Unwrought	728	603	12	Austria 461; Republic of Korea 37; France 30.
Semimanufactures	103	105	20	Austria 50; Netherlands 10.
Uranium and/or thorium:				
Oxides and other compounds	3	--		
Metal including alloys, all forms:				
Uranium	(3)	12	10	Canada 1; United Kingdom 1.
Thorium	(3)	(3)	NA	Mainly from Netherlands.
Vanadium:				
Oxides and hydroxides	1,870	1,806	(3)	China 1,330; Finland 467; Netherlands 50.
Ash and residue containing vanadium	31,635	1,911	63	Italy 709; U.S.S.R. 412; Israel 275.
Metal including alloys:				
Scrap	(3)	--		
Unwrought	(3)	(3)	(3)	
Semimanufactures	267	66	60	France 6.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Zinc:				
Ore and concentrate	592,709	620,810	--	Canada 199,139; Australia 119,069; Peru 87,523..
Oxides	13,986	12,769	56	Netherlands 3,499; France 2,675; Belgium-Luxembourg 1,876.
Blue powder	12,394	13,032	--	Belgium-Luxembourg 10,108; France 1,827; Norway 1,030.
Matte	9,668	10,919	577	Netherlands 4,010; Belgium-Luxembourg 1,681; France 1,542.
Ash and residue containing zinc	58,981	48,298	1,637	United Kingdom 7,629; Netherlands 4,936; Italy 4,614.
Metal including alloys:				
Scrap	19,823	15,514	21	Netherlands 4,581; Italy 2,883; Belgium-Luxembourg 1,602.
Unwrought	167,813	174,214	1	Belgium-Luxembourg 62,331; Netherlands 41,666; France 24,068.
Semimanufactures	23,653	28,951	28	France 18,023; Netherlands 3,527; Yugoslavia 3,234.
Zirconium:				
Ore and concentrate	78,929	83,002	5,786	Australia 38,153; Republic of South Africa 28,296.
Metal including alloys:				
Scrap	20	22	7	Italy 9; Belgium-Luxembourg 3.
Unwrought	6	9	1	France 3; Belgium-Luxembourg 2; U.S.S.R. 2.
Semimanufactures	463	364	156	France 146; Sweden 60.
Other:				
Ores and concentrates	20	--		
Ore and concentrate of precious metals value, thousands	$42,132	$43,425	$12,238	Chile $17,611; Canada $7,078.
Oxides and hydroxides	504	565	28	United Kingdom 227; France 187; Brazil 66.
Ashes and residues	250,860	233,274	892	Canada 155,728; France 466; unspecified 73,590.
Base metals including alloys, all forms	7,297	1,015	467	Austria 114; United Kingdom 59.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	46,504	82,914	661	Greece 63,920; Iceland 9,989; Italy 5,988.
Artificial:				
Corundum	30,644	31,953	686	Austria 5,781; U.S.S.R. 5,067; Yugoslavia 4,151.
Silicon carbide	80,915	67,719	1	Norway 14,842; Italy 2,624; unspecified 42,486.
Dust and powder of precious and semi-precious stones including diamond	433	334	330	Ireland 2.
Grinding and polishing wheels and stones	9,981	8,855	63	Austria 2,339; Netherlands 1,653; Italy 1,579.
Asbestos, crude	63,171	64,943	1,602	Canada 36,259; Italy 14,839; U.S.S.R. 4,102.
Barite and witherite	221,624	198,558	--	France 96,602; China 32,222; Belgium-Luxembourg 26,256.
Boron materials:				
Crude natural borates	58,664	54,634	143	Turkey 53,720; Netherlands 650.
Elemental	(3)	(3)	(3)	
Oxides and acids	22,063	23,733	918	France 9,091; Turkey 6,536; Italy 4,405.
Bromine	7,443	6,071	35	Israel 4,818; United Kingdom 933; France 136.
Cement thousand tons	1,775	1,296	(3)	Belgium-Luxembourg 516; France 336; Netherlands 142.
Chalk	242,897	270,687	15	France 205,488; Belgium-Luxembourg 55,681; United Kingdom 3,522.
Clays, crude:				
Bentonite	114,610	116,903	11,587	Greece 54,225; Turkey 19,001; Spain 15,975.
Ceramic	69,508	54,713	NA	France 30,013; Czechoslovakia 12,602; United Kingdom 10,145.
Chamotte earth	26,172	24,560	2,142	France 11,125; Republic of South Africa 4,925; Czechoslovakia 4,070.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Clays, crude —Continued				
Fire clay	100,369	98,390	10,791	Czechoslovakia 39,132; France 33,392.
Fuller's earth	6,905	9,769	1,425	United Kingdom 6,749; Spain 1,233.
Kaolin	871,793	828,690	100,332	United Kingdom 419,303; Czechoslovakia 143,915.
Unspecified	r119,941	133,504	6,768	Netherlands 64,703; Czechoslovakia 39,749; France 10,952.
Cryolite and chiolite	1,744	1,422	(3)	Greenland 1,421.
Diamond:				
Gem, not set or strung thousand carats	422	490	5	Belgium-Luxembourg 172; U.S.S.R. 130; India 95.
Industrial stones do	1,167	1,182	106	Belgium-Luxembourg 361; Republic of South Africa 294; United Kingdom 149.
Diatomite and other infusorial earth	39,161	38,856	2,005	Denmark 22,044; France 10,250.
Feldspar, fluorspar, related materials:				
Feldspar	46,213	55,193	30	Norway 19,338; Italy 14,978; Finland 11,269.
Fluorspar	233,280	192,543	--	Republic of South Africa 70,225; China 27,077; Morocco 21,502.
Unspecified	64,473	72,781	--	Norway 63,445; Netherlands 9,025; Belgium-Luxembourg 186.
Fertilizer materials:				
Crude, n.e.s	31,199	36,548	1,046	Netherlands 27,230; France 2,804; Peru 1,508.
Manufactured:				
Ammonia thousand tons	497	385	(3)	Netherlands 248; France 98; Austria 14.
Nitrogenous do	3,208	2,385	16	Netherlands 766; Belgium-Luxembourg 396; Austria 264.
Phosphatic do	711	611	(3)	Belgium-Luxembourg 430; France 81; Netherlands 40.
Potassic do	76	65	(3)	France 58; Canada 4; Belgium-Luxembourg 2.
Unspecified and mixed do	1,472	1,401	188	Netherlands 214; Belgium-Luxembourg 155.
Graphite, natural	33,998	37,793	48	China 17,848; Austria 3,612; unspecified 12,105.
Gypsum and plaster	876,859	823,827	144	France 690,389; Austria 116,818; Belgium-Luxembourg 13,427.
Iodine	1,880	1,704	36	Japan 844; Chile 780.
Kyanite and related materials	110,172	80,376	35,924	Republic of South Africa 34,192; France 3,961.
Lime	356,393	332,211	--	France 202,839; Belgium-Luxembourg 46,337; Poland 46,313.
Magnesium compounds:				
Magnesite, crude	6,242	4,918	--	Greece 3,005; Netherlands 671; Spain 576.
Oxides and hydroxides	394,558	414,131	1,104	China 87,403; Greece 59,915; Netherlands 45,956.
Other	2	123	--	Netherlands 100; Austria 23.
Mica:				
Crude including splittings and waste	11,946	11,468	168	India 4,571; China 2,494; France 1,872.
Worked including agglomerated splittings	645	757	20	Belgium-Luxembourg 323; France 229.
Nitrates, crude	2,346	3,345	--	All from Chile.
Phosphates, crude thousand tons	1,943	1,579	718	Republic of South Africa 257; Morocco 224.
Pigments, mineral:				
Natural, crude	296	119	--	Cyprus 54; Netherlands 41; France 17.
Iron oxides and hydroxides, processed	32,765	28,154	--	Belgium-Luxembourg 2,543; Netherlands 1,789; France 1,502
Potassium salts, crude	10,086	203	--	Belgium-Luxembourg 104; Netherlands 99.
Precious and semiprecious stones other than diamond:				
Natural	841	797	25	Brazil 324; Republic of South Africa 180; India 39.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Precious and semiprecious stones other than diamond —Continued				
Synthetic	30	27	5	Switzerland 10; Bulgaria 7.
Pyrite, unroasted	187,042	203,328	--	Finland 106,808; Yugoslavia 87,368; Norway 5,921.
Quartz crystal, piezoelectric kilograms	50	47	NA	NA.
Salt and brine	826,942	652,640	33	Netherlands 484,078; France 120,878; Italy 39,335.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	151,084	105,562	3	Netherlands 54,662; Czechoslovakia 9,603; unspecified 25,742.
Sulfate, manufactured	91,290	70,188	NA	Austria 21,115; Spain 20,347; Belgium-Luxembourg 12,554.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked thousand tons	772	936	(3)	Norway 252; Sweden 235; Austria 110.
Worked do	858	1,000	(3)	Italy 452; Portugal 254; Austria 56.
Dolomite, chiefly refractory-grade do	332	373	--	Belgium-Luxembourg 333; Norway 14; Austria 13.
Gravel and crushed rock do	8,417	8,174	(3)	France 4,866; Denmark 861; Norway 770.
Limestone other than dimension do	1,418	1,355	(3)	Austria 601; France 438; Belgium-Luxembourg 237.
Quartz and quartzite do	69	71	2	Netherlands 20; Belgium-Luxembourg 15; Yugoslavia 14.
Sand other than metal-bearing do	2,873	3,578	1	France 2,040; Netherlands 878; Belgium-Luxembourg 193.
Sand and gravel do	2,411	--		
Sulfur:				
Elemental:				
Crude including native and byproduct	252,801	232,640	43,519	Canada 158,766; Poland 23,953.
Colloidal, precipitated, sublimed	733	1,622	3	Netherlands 964; France 655.
Dioxide	7,254	9,430	(3)	Sweden 4,708; Poland 3,773; Switzerland 505.
Sulfuric acid	177,213	118,312	--	Netherlands 100,942; Switzerland 15,910; Austria 870.
Talc, steatite, soapstone, pyrophyllite	139,082	148,300	920	Austria 57,819; France 32,666; Italy 12,527.
Vermiculite, perlite, chlorite	97,641	108,125	149	Greece 75,386; Republic of South Africa 12,658; Hungary 11,921.
Other:				
Crude thousand tons	1,505	1,521	9	Norway 508; Netherlands 285; Austria 189.
Slag and dross, not metal-bearing do	1,556	1,394	6	Belgium-Luxembourg 518; France 502; Austria 92.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	20,275	21,617	8,168	Trinidad and Tobago 11,763; Albania 658.
Carbon:				
Carbon black	3,680	3,850	1	Netherlands 2,554; United Kingdom 596; France 346.
Gas carbon	60,159	64,554	2,473	France 21,776; Netherlands 18,923; Spain 5,397.
Coal:				
Anthracite thousand tons	33	30	(3)	United Kingdom 16; Republic of South Africa 7; Norway 5.
Bituminous do	9,828	9,967	388	Republic of South Africa 4,067; Poland 2,637; Australia 832.
Briquets of anthracite and bituminous coal do	1	2	--	Mainly from Netherlands.
Lignite including briquets do	4,023	2,493	--	Czechoslovakia 2,485; Austria 5; Yugoslavia 1.
Coke and semicoke do	1,012	949	108	Belgium-Luxembourg 242; Netherlands 135; United Kingdom 125.
Gas, natural: Gaseous million cubic feet	1,873,310	1,590,212	NA	NA.
Peat including briquets and litter	103,948	101,572	9	Netherlands 64,301; U.S.S.R. 32,216; France 2,546.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude -- thousand 42-gallon barrels	491,422	489,730	--	United Kingdom 135,033; Nigeria 71,982; Saudi Arabia 53,228.
Refinery products:				
Liquefied petroleum gas---do----	10,316	9,805	(3)	Netherlands 2,329; United Kingdom 1,880; Belgium-Luxembourg 1,544.
Gasoline ----------do----	96,025	97,436	207	Netherlands 35,643; U.S.S.R. 17,930; Belgium-Luxembourg 7,140.
Mineral jelly and wax ----do----	1,594	1,717	265	France 242; Egypt 185; unspecified 621.
Kerosene and jet fuel ----do----	16,754	18,003	63	Netherlands 13,740; Belgium-Luxembourg 2,182; France 945.
Distillate fuel oil -------do----	158,783	183,106	318	Netherlands 91,922; U.S.S.R. 22,968; United Kingdom 12,794.
Lubricants----------do----	2,516	3,415	121	France 1,054; United Kingdom 885; Italy 393.
Residual fuel oil -------do----	59,763	52,251	--	Netherlands 15,239; U.S.S.R. 9,944 Belgium-Luxembourg 7,074.
Bitumen and other residues do----	2,126	1,764	(3)	Netherlands 591; Hungary 250; France 236.
Bituminous mixtures ----do----	118	119	2	Netherlands 58; France 22; Hungary 18.
Petroleum coke--------do----	6,883	8,056	7,144	United Kingdom 276; Argentina 183.
Unspecified ----------do----	397	--		

rRevised. NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Excludes trade with East Germany.
[3]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Poor ore grades, the high cost of mine operations, stringent environmental controls, strong competition from abroad, and declining world demand for the basic metals led the FRG to close virtually all of its metal-producing mines. The last iron ore mine, Leonie, in Auerbach, east of Nürnberg in Bavaria, which had operated since the Middle Ages, closed in May. In February, MG closed two of its lead-and-zinc mines in the Harz Mountains. These mines employed about 825 workers and were the sole source of byproduct silver in the FRG. The only remaining lead-and-zinc mine, at Meggen, produced mostly zinc. The FRG thus had to rely mainly on imports not only for its iron, lead, silver, and zinc, but also for gold and most other metals. Domestic and imported secondary metals and scrap were refined, and attempts were made to reclaim metals from mine wastes. Preussag Metall AG, near Goslar, for example, was experimenting with reclaiming copper and zinc from waste piles by an in situ biological leaching process using microorganisms mainly *Thiobacillus ferro-oxidans.*[6]

Aluminum.—Vereinigte Aluminium Werke AG (VAW), the largest FRG producer, sold one of its works, Leichtmetall Castens und Krohn (LCK), to the international metal stockholder, Aalco Ltd. of the United Kingdom. LCK, in Hamburg, was a distributor of aluminum semimanufactures. Aalco had four other plants in the FRG—Düsseldorf, Nürnberg, Regensburg, and Stuttgart.

VAW, headquartered in Bonn, produced primary aluminum and aluminum products, coal, gallium, graphite, and materials for ceramics. The company employed about 10,215 workers at its 11 plants.

Alcan Aluminium Werke AG, owned by Canada's Alcan Aluminium Ltd., closed its smelter at Ludwigshafen in February. The plant was producing only at about one-half of its 44,000-ton-per-year capacity. Alcan sold 185,000 tons of aluminum products in the FRG in the first half of the year, down 9% compared with the same period in 1986. At yearend, Alcan's FRG operations were

merged into one company, renamed Alcan Deutschland GmbH, headquartered at Eschborn and Taunus. The merger was part of Alcan's restructuring of its finished and semifinished products lines. Rolled products were to be concentrated at Göttingen, foil at Lüdenscheid, foil finishing at Ohler, and pistons and castings at Nürnberg.[7]

Antimony.—Erdol und Chemie Div. of Preussag developed a method for producing antimony trichloride and antimony trioxide from impure sulfide ores that were previously unusable because of metallic impurities. In the new method, the finely ground ore reacts with gaseous hydrogen chloride in a molten salt. The sulfur is driven off as hydrogen sulfide, which is collected in an alkaline medium and processed into by-products.[8]

Copper.—Norddeutsche Affinerie AG at Hamburg produced about 62% of the FRG's copper and operated the largest primary copper smelter in Europe. However, the company sold 30% of its shares to MIM. MIM also owned about 5% of MG. By yearend, three companies held major stock in the smelter: MG and MIM, 35% each; and Degussa AG, 30%.

Germanium.—KHD Humbold Wedag AG of Köln tested a process for extracting germanium, lead, and zinc, from flue dust collected from lead processing. The CONTOP process consists of a reducing, cyclone-smelting phase, followed by the evaporation of the metals through top-blowing of coal. More than 90% of the germanium, lead, and zinc were precipitated as oxides. The residue also contained significant quantities of SiO_2, Fe_2O_3, chlorides, and fluorides from the coal.[9]

Iron and Steel.—Klöckner Werke AG, which owned 49% of the FRG's last iron ore mine, shut down the Leonie Mine in Sulzbach-Rosenberg near Auerbach in eastern Bavaria in May. Output at Leonie reached a peak in 1962 at almost 19 million tons of ore, or 4.2 million tons of metal content. In 1987, only 500,000 tons was produced; most of the ore was sedimentary and of Upper Cretaceous Age.[10] The mine had operated under the name of Eisenwerk-Gesellschaft Maximilianschutte mbH (Maxhutte). The closure was caused by competition from abroad, difficult underground working conditions due to water problems, and low ore grade. The mine had operated since the Middle Ages, and in 1986, it employed 292 workers, 214 of which were underground miners. In 1987, 263 workers remained. The Maxhutte shutdown cost Klöckner about $230 million in 1987; it had reported an operating profit of $27 million in 1986.

The mine closure turned Klöckner into a producer of flat steel products. Klöckner, the city of Düsseldorf, and the Bavarian State drafted plans to rescue Maxhutte by forming a new steel company. By yearend, a new steel company was formed, Neue Maxhutte Stahlwerke GmbH, integrating the activities of the bankrupt Maxhutte. Bavaria was given 39% ownership and the rest was divided evenly among the seven leading FRG steel companies. Neue Maxhutte was to operate a blast furnace, two oxygen converters, two continuous casters, a blooming mill, and a section mill at Sulzbach-Rosenberg. Also, by yearend, another new company was formed, ESW-Rohrenwerke GmbH, to manage Maxhutte's tube works at Eschweiler, formerly called Echweiler Bergwerks-Verein Huttenbetriebe. The plant produced tubes of 70- to 219-millimeter diameter, and it had an annual capacity of about 60,000 tons. Unemployment in the Sulzbach-Rosenberg area reached 40%, or four times the national average.[11] Since 1980, Maxhutte had received about $115 million in Bavarian State aid and reduced its work force by about 6,500.

In addition to Bavaria, other States were affected by the steel crisis, and the Government pledged $110 million in subsidies to the States of Lower Saxony, North Rhine-Westphalia, and Saarland. The steel companies and the union sought $365 million in Government aid. It was estimated that from 25,000 to 45,000 jobs would be lost in the next 2 years, owing to a weak steel market; The Ruhr Valley of North Rhine-Westphalia would suffer the greatest unemployment. Over 200,000 jobs had already been lost in the valley during the last decade.[12] Since 1980, Hoesch AG, Krupp Stahl AG, Mannesmann AG, and Thyssen AG had invested over $1.2 billion in the Ruhr Valley.

The FRG ranked fifth in the world in the production of raw steel, with 5% of the world's output, and the country's 8 major steel companies were among the top 47 world steelmakers.[13] Almost 85% of the country's total steel output was produced by continuous casting, compared with 77% in 1984. Only Denmark produced steel entirely by continuous casting. By contrast, continuous casting in the U.S.S.R. constituted only

14% of the total. Of the total output, 81.7% was produced by the oxygen process, the rest by the electric process.

Reportedly, FRG authorities had uncovered a steel-smuggling operation involving the sale by European traders of more than $120 million of steel from the German Democratic Republic (GDR) in Western Europe, the United States, and Turkey in 1985 and 1986.[14] The companies were accused of falsely labeling the steel as of EEC origin to evade the Community's quota on GDR steel. According to FRG customs in Düsseldorf, which led the investigation, the steel traders included well-known companies. A Government official confirmed that 160,000 to 200,000 tons of GDR steel worth up to $90 million had been "smuggled" into EEC countries, and that another 74,400 tons of GDR steel was sold in the United States, probably as steel from the EEC. In addition, 51,000 tons of the contraband steel was exported to Turkey with false papers. The department said that it was investigating the whereabouts of 900,000 tons of GDR steel shipped from the FRG free ports of Lübeck and Hamburg in 1985 and 1986.

The FRG's seven major steel companies had operated profitably since 1984 and Salzgitter AG since 1985.[15] By 1987, however, most FRG mills had become unprofitable. Thyssen Stahl AG, Europe's largest privately owned steel mill, announced plans to reduce the work force at its Niederrhein works at Oberhausen by a further 3,000 workers to only 1,000; the plant had employed more than 9,000 workers in 1978. The plate-rolling mill at Oberhausen was to remain closed until mid-1988. Also, there were plans to cut 2,900 jobs at Hattingen's Heinrichshutte plate mill, and to close it in 1988. Both of Hattingen's blast furnaces were in the process of being taken out of operation in 1987. Since December 1986, Thyssen closed two unprofitable section production plants, thus completely abandoning light sections. Only one 3.7-meter plate mill remained, at Duisburg. Thyssen cut its raw steel production 7% below 1986 levels, owing to a decline in steel prices and sales. Thyssen Edelstahlwerke AG, the company's stainless steel producer, was Thyssen's only profitable division. The company pledged to invest about $1.5 billion worldwide by 1988, mostly in the Rhine and Ruhr areas.

Hoesch Stahl AG, the second-largest steel producer, was one of the companies that was profitable. It concentrated on the production of high-value sheet products, while its other steel operations registered losses.

Krupp Stahl AG made a $3 million profit; that figure was, however, $40 million below the 1986 result. Most of the losses came from the declining sales of steel sections. Restructuring costs associated with a planned merger and strikes at its Rheinhausen steelworks in Duisburg cost the company about $18 million. The company announced in November plans to close Rheinhausen in the industrial Ruhr, causing the 5,300 workers to demonstrate for job security. In a compromise, the company was to proceed with the mill closure but would create substitute jobs or give early pensions to all but 1,300 of its workers.[16] The Iranian Government owned 25.1% of Krupp and had a representative on the supervisory board. Consistent with the trend in the FRG steel sector, Krupp was moving away from bulk steel and into special steels, capital-goods manufacturing, and trading. Krupp's steel sales accounted for only about 20% of total group steel sales, compared with 27% in 1980.[17] Krupp began as a shipbuilding concern in 1896 and diversified into steel. In 1987, 90% of its research and development funds were spent on machinery, equipment, electronics, process engineering, metallurgy and materials, representing 6% to 8% of the group's turnover.[18]

Mannesmann AG, the country's fourth-largest steel producer, was also a leading manufacturer of steel pipes and tubes, machinery, and metallurgical plants. In 1987, the group's sales fell by 8%. Foreign sales, which accounted for 61% of the company's activities in 1986, fell 5% during the year. Also, Klöckner AG reported losses from its steel division, Klöckner Werke.

Lead and Zinc.—Preussag, the FRG's largest producer of base metals, made only a modest profit, although sales improved by about 10%. The company acquired the metal trading company, W & O Bergmann GmbH & Co., whose profit was $1.4 billion in 1986. The company announced plans to close its 75,000-ton-per-year secondary zinc smelter at Harlingerode in 1988. In 1987, it operated at only two-thirds capacity. The plant employed about 500 workers and was the last operating zinc smelter in Europe using the old New Jersey zinc process. The secondary lead unit at Harlingerode, which was to remain in production, produced more than 40% of its secondary lead—about 45 tons—from spent batteries. The company was to concentrate its zinc production at its second, 120,000-ton-per-year, electrolytic re-

finery at Nordenham. Preussag became the sole owner of the 120,000-ton-per-year-capacity Nordenham lead smelter by acquisition of the 50% owned by the Swedish firm, Boliden A.B.[19] Production at the 55,000-ton-capacity Goslar zinc refinery was stopped for economic reasons.

The FRG Government announced in February plans for the indefinite closure of the Rammelsberg and Bad Grund lead-zinc-silver mines in the Harz Mountains because of falling prices and high operating costs. The mines had operated since the Middle Ages, and, in 1986, they employed 437 and 387 workers, respectively. In 1986, the Rammelsberg Mine produced 279,000 tons of ore, and the Bad Grund Mine produced 267,000 tons. The combined yield was about 113,000 tons of zinc in concentrate and 25,000 tons of lead in concentrate. The reserves at Rammelsberg were almost exhausted. The mines were the sole remaining source of byproduct silver in the FRG. The closure left one operating lead-and-zinc mine, the Meggen Mine east of Bonn, owned by MG. It has been in operation for more than 130 years and produced about 1 million tons of lead and zinc ore per year, mostly destined for zinc concentrate production.

Hamburger Metallkonter GmbH reportedly discovered a significant lead-zinc-silver prospect in Bavaria, close to the Czechoslovak border, using geochemical data. The anomaly is 3 kilometers long along the strike and up to 1 kilometer in width.[20]

Other Metals.—Degussa developed a powder-metallurgy injection-forming process, followed by binder elimination and sintering, for the production of highly complex hard metal parts, such as tungsten carbide with cobalt or nickel binders. With the Swiss company Vereinigte Drahtwerke Biel AG, Degussa built a pilot plant in the FRG for the production of up to 2 million parts per year, fabricated in two separate furnaces. The alloys, Bidurit FX-15, FX-30, and Ni-15 are composed of tungsten carbide and tantalum-niobium carbide and with cobalt binders at 7.5% and 15%, respectively, and tungsten carbide with 7% nickel binder. The two companies experimented with other alloys, such as ferrous metals, nickel superalloys, and others. The mechanical strength values obtained by this process were equivalent to those obtained by the conventional sintering methods.[21]

INDUSTRIAL MINERALS

Barite.—Only three operating barite mines remained in the FRG; the others had been shut down either because they became uneconomical or their reserves were depleted. Exploration, however, continued in the Harz Mountains near the Fulda River in the Dill area and at the Nohfelden-Eisen Mine in Saarland. Offshoots of the main ore body were discovered near St. Andreasberg in Harz, and Siegbach-Wallenfels and Oberscheld in Dill, with no plans to exploit them. The FRG met about 56% of its apparent consumption from domestic resources; 70% of this output was consumed in the production of chemicals and lithopone, 25% in fillers, and the rest in drilling.

Sachtleben Bergbau GmbH and Kali-Chemie AG were the two major domestic barium chemicals producers. The two companies jointly owned Duetsche Baryt-Industrie Dr. Rudolf Alberti & Co., which operated a mine at Wolkenhugel and a processing plant at Bad Lauterberg. Production capacity was 50,000 tons per year of filler-grade and 5,000 tons per year of chemical-grade barites. Sachtleben also operated mines at Dreislar and Wolfach, with plants in Hallenberg-Liesen and Wolfach, producing 50,000 tons per year of lumpy barite and 60,000 tons of filler as well as some barite for drilling. In 1986, the work force at the Dreislar Mine had been reduced by 50% to 22 workers, and production was cut from 65,000 to 40,000 tons because of high operating costs.[22] Kali-Chemie also operated subsidiaries in Italy and France, and its mining operations in Córdoba, Spain, were closed at midyear. The company was the sole supplier of barium and strontium carbonate to the Republic of Korea. The chemicals were manufactured by Kali-Chemie at Bad Honningen near the Rhine and at Massa in Italy. Other FRG processors of barites were Hansa-Metall Braun Mineral-und Metallhandels GmbH at Duisburg and Johannes Scheruhn GmbH & Co. Scheruhn did not operate its Talkum-Bergbau Mine in 1987 owing to a decline in profitability.[23]

Bromine.—Kali und Salz AG, headquartered at Kassel, was the only producer of bromine in the FRG. Of the three previously operating mines, only the 2,500-ton-per-year Salzdetfurth Mine, north of Kassel, remained open. Production from both the Friedrichsthal and the Berg

annssegen-Hugo Mines was discontinued.

Cement.—The FRG was the second-largest producer of cement in the EEC. About 36 cement companies operated 65 plants. The leading producers included, in descending order, Heidelberger Zement AG, Dyckerhoff AG, Anneliese Zementwerke AG, Alsen-Breitenburg Zement-und Kalkwerke GmbH, and Nordcement AG. Production had steadily declined from 35 million tons in 1979 because of falling consumption and low-cost imports from the centrally planned countries. The FRG exported about 5% of its production, mostly to the Netherlands, and largely in the form of special types of cement including oil well and various construction cements, some for FRG companies working in those countries.[24] Heidelberger Zement held a 65% ownership in Lehigh Portland Cement Co., a U.S. company.

Bonner Zementwerke GmbH, the country's oldest cement company, ceased production and sold its kilns to Turkey. Clinker production was stopped by Hannoverische Portland Zementfabrik AG, Heidelberger Zement in Neumarkt, Hellbach-Zement GmbH, Kalk-und Zementwerke Marienstein AG, and Zementwerk Saar GmbH. Other companies improved their operations by installing high-efficiency separators, filters, high-pressure grinding rolls, and conveying and dispatching systems.

Lime.—The FRG was the world's fourth-largest producer of lime. With some yearly fluctuations, production had remained quite stable for more than a decade. Two companies dominated the industry; Rheinisch-Westfalische Kalkwerke AG (RWK), the largest, headquartered in Wuppertal, and Rheinische Kalksteinwerke GmbH of Wulfrath (RKW); Thyssen AG owned 75.1% of the latter. Both produced only burnt lime. Several smaller companies also produced sintered dolomite, soft-burned dolomite, and hydrated lime. RWK quarried and burned Massenkalk Devonian limestone at three locations near the company's headquarters, about 12 miles northeast of Düsseldorf. RWK also quarried Devonian limestone at four sites: Darnap, near Wuppertal; Honnetal, near Dortmund; Stromberg, near Bingen on the Rhine; and Steeden, near Limburg. More than 72% of the burnt lime was exported to European countries for use by the iron and steel and construction industries.

Potash.—Kali und Salz ranked fourth in the world in the production of potash, and the FRG was also the second largest market in Western Europe. However, production had remained virtually unchanged for the past 2 years because of low demand. Of the eight operating mines, three in the Hannover area were directly affected by declining sales. The smallest mine at Siegried-Gieser was to close permanently while capacities were reduced at the Bergmannssegen-Hugo and Salzdetfurth Mines. Those actions also affected the jobs of 900 workers.

Kali Export Gesellschaft (KEG) handled all FRG's sales to non-EEC countries in Europe, which made up about 30% of its total exports. KEG's next largest market was Asia, where sales were based primarily on long-term contracts.[25] The 1986-87 12-month exports totaled about 1.29 million tons of K_2O. The FRG had no restrictions on imports, but they remained low and unchanged at about 110,000 tons per year of K_2O, originating mostly in France and the German Democratic Republic.

Synthetic Wollastonite, Diopside, and Mayenite.—FRG's Rheinische Kalksteinwerke GmbH in Wulfrath was a major European commercial producer of synthetic lime-containing minerals. Wollastonite and diopside were manufactured for use in ceramics and metallurgy. Mayenite, the most recent entry in the company's inventory, was used only in secondary metallurgy. The minerals were synthesized in a modified rotary kiln.[26]

MINERAL FUELS

Coal and nuclear energy remained the primary sources of electric power, which increased by 2.2% in 1987 compared with that of 1986. The share of nuclear power rose from 3% in 1970 to about 37% in 1987, while that of petroleum fuels fell from 15% to less than 2% in the same period. More than 50% of total electric production was generated from domestic coal. The share of oil in primary energy consumption including transportation, however, was the highest at 42%, followed by coal at 19%, natural gas at 17%, nuclear power at 11%, and lignite at 8%. About 64% of the primary energy fuel sources was imported. Nuclear power stations continued to operate at nearly 80% of capacity. The Government also continued to support new reactor technologies. It remained committed to the construction of a spent fuel reprocessing plant in Wackersdorf, Bavaria, despite some active opposition to nuclear power.

Coal.—There were 32 operating coal

mines in the FRG. Since 1981, the production of coal had continued to decline. About 2 million tons of coal was stockpiled during 1987, increasing the existing stock to 15 million tons. Production in the mines was more than 115% of normal output. According to some reports, three main coal producers were to reduce their capacities: Ruhrkohle AG by 10 million tons, Eschweiler Bergwerks-Verien AG by 3 million tons, and Saarbergwerke AG by 1 million ton.[27] The cost of domestic coal was more than three times the price of imported coal. Despite this, however, only about 9 million tons of coal was imported, and coal production subsidies continued, amounting to about $7 billion per year. Only about one-fifth of the coal mines were competitive, and for environmental reasons, coal mining was moving north into the rural Muensterland area. The industry employed about 164,000 people in 1986, compared with 204,000 in 1973.

Natural Gas.—Natural gas was the third-largest primary energy source in the FRG. Consumption of natural gas rose from a 1986 decline because of cold weather and higher sales to industry. About 27% to 30% of gas supply came from domestic sources. On May 31, 1986, a consortium of Western European companies, including the FRG importers (Ruhrgas, Thyssengas, and Brigitta und Elwerath Betriesbsfuhrungsgesellschaft) agreed to import gas from Norway's Troll and Sleipner North Sea fields. The agreement, approved by the Government in August, covered imports of about 282 billion cubic feet of gas per year during the years 2000 to 2020. The agreement was another step toward broadening the Western European sources for the FRG gas market, thus assuring a more stable supply.

Petroleum.—Production declined for the third year, and domestic output contributed only marginally to the FRG's energy balance. Because the FRG was the largest European market for petroleum and had adopted strict emission controls, the Government was concerned with diversification and security of supply. Dependence on oil from the Organization of Petroleum Exporting Countries had been cut by more than one-half during the last 15 years and the FRG paid less for its oil imports, $9.7 billion, than in the previous year. Because of international competition and overcapacity in the European refining industry, however, FRG oil companies continued to lose revenues. Refining capacity had been halved since 1978, to 612 million barrels per year in 1987. Ruhr Oil GmbH in Gelsenkirchen, the largest refinery, has a capacity of about 80 million barrels per year and was jointly and equally owned by Veba AG and Petroleos de Venezuela SA. Shell Oil Co. was the country's major refiner. FRG's refineries met about 70% of the country's petroleum product demands. To maintain capacity, Holborn Europa Reffinerie GmbH, a subsidiary of Coastal Corp. of the United States, took over the mothballed Esso Corp. refinery in Hamburg, which had a capacity of 34 million barrels per year. Opening of other closed plants was being considered.

Of the 50 to 60 independent oil trading companies in the FRG, most received their supplies from the Amsterdam-Rotterdam-Antwerp area, mainly by barge. In 1986, about 205 million barrels of oil entered the FRG at Emmerich on the Rhine River. The Rhine was the main transport route, usually in 1,200-ton barges. Some of the oil was transported through pipelines. The FRG had 1,065 miles of pipeline for crude and 315 miles for refinery products.[28]

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[1]Physical scientist, Division of International Minerals.
[2]Where necessary, values have been converted from the deutsche mark (DM) to U.S. dollars at the rate of DM1.65=US$1.00, for yearend 1987.
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The Mineral Industry of Ghana

By David J. Ellis[1]

With the decline in the price of cocoa, Ghana's principal export commodity, the increase in the value of revenue from the mineral industry provided a necessary boost to export earnings. Export revenue from the gold, manganese, diamond, and bauxite industries amounted to approximately $170 million,[2] or 21% of total export value, compared with 17% in 1986. The increase was mainly a result of increased gold production and the continued bull market for gold.

The Economic Recovery Program (ERP), begun in 1983, was continued with the support of the International Bank for Reconstruction and Development (World Bank), the International Monetary Fund (IMF), and other international banking agencies. The goals of the ERP were the realignment of relative prices to promote economic growth and increase exports, the rehabilitation of social and economic infrastructure, the restoration of fiscal discipline, and the encouragement of domestic savings and investment. In the continuing pursuit of these objectives, Ghana sought an Extended Fund Facility of $190 million and a Structural Adjustment Facility of $100 million from the IMF, both of which were approved in November. Ghana also benefited from pledges of multilateral and bilateral aid amounting to approximately $800 million.

Production of gold increased at each of the four working operations in Ghana, in response to the rehabilitation stimulated by a 5-year plan started in 1985. Changes in the mining and investment codes heightened interest in gold mining, evidenced by the issuance of more than 30 exploration licenses since 1986. Four joint ventures converted their exploration rights into mining programs in 1987, with some new gold mining operations expected to be in production in 1988.

Transportation problems continued to plague the manganese and bauxite industries, based at Nsuta and Awaso, respectively. Poor roads and railroads and dilapidated harbor facilities at Takoradi, the shipping terminal for manganese and bauxite, held exports from the Ghana National Manganese Corp. (GNMC) and Ghana Bauxite Co. (GBC) below production capabilities. However, a portion of the loans pledged by various international aid agencies was earmarked for the rehabilitation of Ghana's badly deteriorated major roadways, rail systems, and port complexes.

The transfer of the focus of alluvial diamond mining operations from the depleted Akwatia facilities to nearby Birim was almost completed in 1987. However, the continued need for new equipment and machinery prevented production from reaching the projected 1 million carat mark. Ghana continued to be plagued by the illegal mining and selling of diamonds and gold, because official agencies could not match the prices offered by illicit buyers. Estimates of the foreign exchange lost by this undocumented export varied between $10 to $30 million per year.

Two oil companies were involved in exploration activities in Ghana, one onshore and one offshore, but no oil production has occurred since 1984. Rehabilitation of the oil refinery at Tema continued with the aid of a loan from the European Investment Bank (EIB).

PRODUCTION AND TRADE

Ghana experienced a trade deficit of $54 million, compared with the positive balance of $16 million achieved in 1986. The value of both imports and exports increased, with exports valued at $787 million and imports at $841 million. Imports of oil products accounted for almost 20% of spending. Members of the European Economic Community continued to be Ghana's principal trading partners, taking 38% of exports and providing 49% of imports. The United States was also a major trading partner, receiving 21% of Ghanaian exports and providing a slightly smaller proportion of Ghana's import needs. United States-Ghana trade was dominated by imports and exports connected with Volta Aluminium Co.'s (VALCO) aluminum smelter.

Production of gold increased 14% more than that of 1986 as the first effects of the rehabilitation program at existing operations were felt. Ashanti Goldfields Corp. (Ghana) Ltd. (AGC) produced almost 280,000 troy ounces of gold, an increase of 13% compared with that of 1986. AGC announced earnings of $118 million, of which $45 million was profit.

Total production at the three State Gold Mining Corp. (SGMC) operations at Dunkwa, Prestea, and Tarkwa was up 21% compared with that of 1986, with production of 8,600 ounces, 22,190 ounces, and 18,259 ounces, respectively.

Production and exports of bauxite increased slightly, with the value of shipments estimated to be $5.2 million, compared with $5.0 million in 1986. Almost all of the production was delivered to British Aluminium Co.'s (British Alcan) plant in the United Kingdom. Production of aluminum increased 20% over that of 1986, with shipments totaling about 146,000 tons, 90% of which was delivered to Kaiser Aluminum & Chemical Corp. and the remainder to Reynolds Metals Co., both of the United States.

Production and exports of manganese were down 13% and 5%, respectively, with export revenue decreasing to $7.8 million compared with $8.2 million in 1986. Principal markets for Ghanaian manganese ore were Belgium, the Federal Republic of Germany, Japan, Norway, Romania, and Spain.

Diamond production was down about 10% compared with that of 1986, although the value of sales increased slightly. The diamonds were sold through a system of limited auctions attended mainly by European diamond buyers.

The policy of using weekly auctions to determine the exchange rate for the Ghanaian cedi continued in 1987, and the cedi continued to devalue against the U.S. dollar as it approached the lower exchange rate of the parallel market. Despite a continued growth of real gross domestic product, estimated to be 4%, inflation increased to 35%, compared with 25% in 1986, and the debt service ratio increased to 54% of export revenue.

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

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
Aluminum:					
Bauxite, gross weight ____ metric tons	70,200	44,000	170,000	226,000	[3]230,000
Metal, smelter, primary ____ do	42,453	NA	48,550	124,570	[3]150,000
Cement, hydraulic[4] ____ thousand metric tons	290	229	363	219	[3]274
Diamond:					
Gem[e] ____ thousand carats	34	35	60	[3]84	[3]65
Industrial[e] ____ do	306	311	572	[3]438	[3]400
Total ____ do	340	346	632	522	[3]465
Gold ____ thousand troy ounces	276	287	299	287	[3]328
Iron and steel: Steel, crude[e] ____ metric tons	5,400	5,400	5,400	5,000	5,000
Manganese:					
Ore and concentrate, gross weight ____ do	173,000	268,700	316,000	340,000	[3]295,000
Mn content ____ do	69,216	107,480	130,000	140,000	120,000
Petroleum:					
Crude[e] ____ thousand 42-gallon barrels	730	730	100	--	--
Refinery products:					
Gasoline ____ do	2,150	1,460	[e]1,000	[e]1,000	1,000
Jet fuel ____ do	248	224	[e]200	[e]200	200
Kerosene ____ do	597	666	[e]600	[e]600	600
Distillate fuel oil ____ do	1,220	1,270	[e]1,000	[e]1,000	1,000

See footnotes at end of table.

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

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
Petroleum —Continued					
Refinery products —Continued					
Residual fuel oil thousand 42-gallon barrels	2,630	2,120	[e]2,000	[e]2,000	2,000
Other do.	81	81	[e]80	[e]80	80
Refinery fuel and losses do.	257	216	[e]200	[e]200	200
Total do.	7,183	6,037	[e]5,080	[e]5,080	,080
Salt[e] metric tons	50,000	50,000	50,000	50,000	50,000
Silver, mine output, Ag content thousand troy ounces	14	14	14	14	16

[e]Estimated. [p]Preliminary. NA Not available.
[1]Table includes data available through July 22, 1988.
[2]In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) are produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.
[3]Reported figure.
[4]All from imported clinker.

COMMODITY REVIEW

METALS

Aluminum.—A second successive year of abundant rainfall was instrumental in the maintenance of a steady supply of electricity from the Akosombo and Kpong hydroelectric power stations, which provided the power to VALCO's smelter at Tema. Therefore, production increased for the third year in a row following the disastrous dry spell and production shutdown in 1984. Four potlines were in operation during the year, and VALCO's management hoped to be able to occasionally run five potlines in 1988.

Aluminium Enterprises Ltd., a Ghanaian company, was looking for foreign partners for a joint-venture project to set up a second rolling mill at Tema. The project had a planned initial output of 10,000 tons per year and would serve to provide for both domestic shortfall and export markets.[3] Aluworks Ghana started production of aluminum coils and sheets at Tema in 1985.

Bauxite production at the Awaso Mine, operated by the GBC (Government of Ghana, 55%, and British Alcan, 45%), fell below the production target of 260,000 tons because of equipment failures early in the year and continued problems with transportation. Priority was given to rehabilitation and replacement of parts on the western railway line linking Awaso and the port at Takoradi where the bauxite is exported. A new feasibility study on the Kibi bauxite deposits northwest of Accra was conducted by a team of experts from the U.S.S.R. Negotiations with various agencies about possible development of the Kibi deposits have been proceeding intermittently since the early 1970's.

Gold.—The gold mining industry in Ghana continued to reap the benefits of the enactment of the 1986 Minerals and Mining Law, with more than 30 foreign companies applying for prospecting and mining licenses since the new law was passed. Some of the important benefits provided by the progressive new mining code were the right to retain not less than 25% of foreign exchange in an external account; the abolition of export levies and withholding taxes, which were replaced by a royalty of 3% to 12% of total revenue; and capital allowances, with which 75% of capital investment could be written off during the first year of a mining venture and 50% in subsequent years.

Those new provisions, accompanied by the devaluation of the cedi to a more realistic level and the ongoing mine rehabili-

tation programs, led not only to the imminent development of several new mines but also to increased production from existing operations.

Rehabilitation progressed on schedule at AGC's Obuasi Mine as well as at the SGMC's operations at Dunkwa, Prestea, and Tarkwa. At Obuasi, the 5.5-meter-diameter George Cappendell shaft was completed by yearend and was to be commissioned in 1988 and used to develop high-grade quartz ore bodies in the southern area of the mine. Two other shafts were in the process of being sunk, and another shaft was revamped in an effort to increase ore production to 980,000 tons per year. These new shafts will provide access to three major ore bodies outlined for development in the 5-year plan and will shift the emphasis from the northern to the southern part of the mine.

Two more ventilation shafts were also being put in using a new raise borer. A conveyor system was also being installed to expedite ore movement in the southern section. New equipment was purchased for stope production and haulage, including larger capacity mine cars to travel on renovated track on the major levels.

At the processing plant, new crushers were in the process of being installed and flotation cells were replaced. Humphrey spirals were installed as an additional stage in the gravity concentration section. Carbon-in-pulp processing was planned to replace the current cyanide-zinc precipitation.

As part of another effort to increase production, treatment of old mine tailings was scheduled to start in 1988. A recovery plant with a capacity of 1.8 million tons per year was ordered. The plant would be able to recover up to 40,000 troy ounces of gold yearly. Two stockpile dischargers were also ordered to access the old tailings for reprocessing.[4]

The SGMC continued its rehabilitation work and training program with the guidance of the Canada-Ghana Mining Group (CGMG) management team. The CGMG advisory team was hired in 1985 to lay out a comprehensive plan for rehabilitation of the three remaining SGMC operations and to train Ghanaians to take over operations at the end of the 5-year plan. There was increased output at all three SGMC facilities as a result of new equipment and development of 4 out of 14 targeted new mining centers outlined in the evaluation completed in 1986.

Because of repairs and rehabilitation at the Dunkwa alluvial operations, 2.9 million cubic yards of ore, the largest total since 1975, was dredged. Plans were made for the purchase of some new dredges to replace ones that were beyond repair.

Because of repairs and replacement of some mining equipment, about 162,000 tons of ore was milled at Prestea, the most since 1981. The implementation of a similar program at Tarkwa resulted in the milling of almost 110,000 tons of ore, an increase of almost 50% more than in 1986.

The Government of Ghana was negotiating with the World Bank for an additional $40 million credit in support of the rehabilitation project. There was a possibility that one or more of the SGMC mines would seek private funding through a joint-venture arrangement.

Among the newcomers to the gold mining industry in Ghana, the closest to production was Southern Cross Mining Ltd. (SCML), a joint venture between Northern Queensland Co. Ltd. of Australia (70%) and the SGMC (30%), which was redeveloping mining operations at Konongo and Obenemase. Konongo had been operated by SGMC between 1965 and 1984, when it was closed due to supposed lack of reserves. Based on exploratory work done in 1986, SCML expected to begin production in 1988 of about 2,000 ounces of gold per month from surface mining. At full capacity, production was estimated to reach 30,000 to 40,000 ounces per year.

Another operation that reached the mining license application stage in 1987 was Teberebie Goldfields Ltd., a joint venture between the Pioneer Group Inc. of the United States (65%), Glencar Explorations PLC of Ireland (25%), and the Government of Ghana, 10%. This 26-square-kilometer concession lies south of Tarkwa and is an extension of the Tarkwa Banket Reef. Proven and probable reserves were estimated to be 5.68 million tons averaging 2 grams of gold per ton, with an additional 11 million tons of possible reserves. Production was expected to begin in midyear 1988, in the form of an open pit operation with gold recovery by heap leaching.

Canadian-Bogosu Resources Ltd. (CBRL), a joint venture between Sikamen Gold Resources Ltd. (SGRL) of Canada (40.5%), Denison Mines Ltd. of Canada (27)%, Exall Resources Ltd. of Canada (13.5%), the Government of Ghana (10%), and the Interna-

tional Finance Corp. (IFC) (9%), applied for a mining lease on about one-third of the 150-square-kilometer Bogosu concession. Exploration continued on the remaining part of the concession. SGRL, the operator, was underwritten at $1.65 million and listed on the Toronto Stock Exchange in January. CBRL conducted exploration and a prefeasibility study at an estimated cost of $3 million during 1987. The Bogosu concession area was part of a concession owned and operated by Marlu Gold Mining Areas Ltd. from 1934 to 1955, during which period 920,000 ounces of gold was recovered at an average grade of 0.12 ounce per ton. The Bogosu deposits were along an 18-kilometer section of the same regional fault system on which other large gold mines, such as Obuasi and Prestea, were discovered.

Results of the prefeasibility study were released in June with total reserves estimated at 5.78 million ounces. Of that, 471,000 ounces was proven, 1.26 million ounces was probable, and 4.0 million ounces was possible. In addition, there were two major underground sulfide ore deposits that were not included in the study results. The capital costs of development of a mine and plant were estimated to be $25 million, with production of 75,000 to 100,000 ounces of gold annually when full capacity is achieved. Average production costs were estimated to be between $134 and $150 per ounce, with a plant treating 1.5 million tons of ore per year from four ore bodies. Initial development would be by open pit mining of oxide ore and reprocessing of mine tailings, with eventual underground mining of sulfide ore as a possibility for development after further exploratory work. A feasibility study was expected to be completed by yearend 1988 and production planned by midyear 1989. The IFC was to provide debt financing for the development.

Sun Gold (Ghana) Ltd., a joint venture between Sun Gold Ltd. of the United States and Akyem Abuakwa Finance Development Co. of Ghana, was issued a mining lease for a 140-square-kilometer concession at Atiwa in eastern Ghana. Installation of infrastructure and a plant for alluvial operations was planned.

There were several other joint ventures that were well advanced in rehabilitation of former mines and/or new exploration activity for gold. Ghana-Libyan Arab Mining Co., a joint venture between Ghanaian and Libyan interests, was involved with reactivating the abandoned surface mining operations at Bibiani, in the Western Region. Purchase of a gold tailings retreatment plant to process 30,000 tons of ore per year was accomplished in 1987.

Titan Resources Ltd. of Australia completed basic infrastructure on the Eduapriem Peasem gold project in December. Results of analysis of samples from a trenching program were awaited.

Kenbert Ltd. and three other Canadian firms were doing rehabilitation work at the Adowsena-Ntronang Goldfield, with financing from the Canadian Export Development Corp. Adowsena-Ntronang was formerly operated by Ashanti Adowsena (Banket) Goldfields Ltd., and is located approximately 40 kilometers southeast of Konongo. Other operations were proceeding at Osenase (Eastern Region) and at Ankobra near Prestea.

Among other developments in the gold industry, the Government of Ghana announced that an agreement was signed with the U.S.S.R. for the rehabilitation of the abandoned Tarkwa gold refinery. Repair work was estimated to cost $1 million and would provide for a refining capacity of over 800,000 ounces per year.

Manganese.—GNMC received a $6 million loan from the EIB that was used to purchase new equipment, and to finance rehabilitation work at the Nsuta Mine and plant and along the railway between Nsuta and the port at Takoradi. GNMC has been mining both manganese oxide and manganese carbonate, but the sales value of the oxide ore has been much higher than that of the carbonate ore. Reserves of oxide ore were estimated to last only 4 more years, although reserves of the carbonate ore were plentiful. To gain more value for the carbonate ore in 1979, GNMC had contracted for the building of a large kiln to roast the carbonate ore and convert it to manganese oxide. The kiln was completed in 1982 but was never commissioned because of a contract dispute with the builder over the financing for an electrical substation to prevent potentially damaging power surges.

GNMC was working with the Romanian mining agency Geomin in an investigation of the potential for development of new reserves of manganese carbonate ore.

INDUSTRIAL MINERALS

Cement.—The Ghana Cement Works continued to produce cement using clinker imported from the German Democratic Re-

public. Cement production, although up from the 1986 level, was still far below capacity and demand.

Diamond.—Despite a change in the focus of mining operations from the exhausted Akwatia deposit to the fresh reserves in the Birim River Valley, diamond production did not reach the 1-million-carat level forecast by Ghana Consolidated Diamonds Ltd. and even decreased compared with 1986 production levels. The decline in production was the result of the continued need for rehabilitation of the diamond processing facilities and the purchase of new equipment. Fine gold was being recovered at a rate of 225 ounces per month, and another plant for gold recovery was in the process of being installed.

MINERAL FUELS

The IFC acquired a 15% interest in the 650,000-acre Keta Basin onshore concession on which Diamond Shamrock International Petroleum Co. of the United States and the Ghana National Petroleum Corp. were operating a joint-venture program. The IFC provided $4.5 million for the ongoing program, which included plans for seismic data acquisition, drilling of three exploration wells, and drilling of one appraisal well.

In April, Amoco Ghana Petroleum Co., a subsidiary of Amoco Production Co., signed an exploration agreement with the Government of Ghana. The agreement covers 10 concession blocks totaling 1.4 million acres off the southeastern coast. During the initial 3-1/2-year period, Amoco was scheduled to carry out a 2,200-kilometer seismic program and to drill one exploratory well. There is an option to allow Amoco to extend the agreement to 7 years.

A loan of $8 million from the EIB was slated for use in the second stage of the rehabilitation of the oil refinery at Tema, begun in 1984. The loan was to be repaid over 15 years with a 5-year grace period. The refinery was scheduled for a doubling of its capacity, which is currently 28,000 barrels per day.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Ghanaian cedis (C) to U.S. dollars at the rate of C161.29=US$1.00.

[3]Metal Bulletin Monthly (London). No. 196, Apr. 1987, p. 121.

[4]Mining Magazine (London). V. 155, No. 8, Aug. 1987, pp. 122-129.

The Mineral Industry of Greece

By Walter G. Steblez[1]

Greece's mineral industry showed a downward production trend in 1987. The output of bentonite, chromite, lead, magnesite, nickel, pyrite and zinc declined compared with that of 1986; only barite, bauxite, lignite and kaolin showed slight gains during the year. The production declines in the mineral sectors paralleled the overall performance of Greece's industry. In 1987, industrial production declined by 2% compared with that of 1986, and was below the output level of 1980. Compared with 1980, Greece's industrial output from 1981 to 1987 registered only slight increases during 1981, 1985, and 1986. According to the country's Statistics Bureau, out of 20 industrial branches, 12 remained below 1980 production levels; these included the industrial minerals, metallurgical and metals fabricating sectors.[2] Moreover, the growth rate of the country's gross domestic product in 1987 declined compared with that of 1986. In 1987, Greece continued to be an important European producer of bauxite, cement, industrial minerals, ferroalloys and nonferrous metals. The Greek-Soviet alumina project and the uncertainty about the future of Larco S.A., Greece's ferronickel producer, continued to be the main issues of the country's mineral industry in 1987. By yearend, all the details for the construction of the alumina plant were finalized, including its relocation. Larco came under scrutiny for possible closure and/or privitization.

In the fuels sector, a dispute arose between the Governments of Greece and Turkey over petroleum exploration rights in the Aegean. There was also a dispute between the Government of Greece and the Prinos oil consortium, the North Aegean Petroleum Corp. (NAPC), concerning the nationalization of the consortium's assets.

Government Policies and Programs.—The Government policy instituted in 1981 to promote state control over the economy and mineral industry was reappraised in 1987 owing to (1) the decline of incentives in Greek industry and competitiveness of goods and services in the market, (2) a steep drop in private investment capital in the Greek economy, and (3) pressure from the European Economic Community (EEC) to establish a free, unified market covering all EEC member states by 1992. To meet the 1992 deadline and reverse the decline of the country's economy, the Government waived a number of restrictions placed on state-controlled enterprises that earlier prevented normal business transactions. These policies restricted the hiring and firing of state employees and abolished management incentives. The Greek Government also abandoned the practice of worker control of day-to-day commercial operations.[3] At the same time, the Government made serious efforts to attract foreign investment in the alumina, bauxite, lignite, and steel industries. The results were less than satisfactory. Most investors, who planned from 5 to 15 years into the future, lost confidence in the Greek investment climate owing to periodic reversals of Government regulations, and the Government's longstanding policy of bringing most of the country's major industries under its control.

In 1987, more than one-half of Greece's mining enterprises were state-owned, and efforts to nationalize NAPC's assets during the year added even more uncertainty to stated Government aims.

PRODUCTION

The mineral industry's overall negative performance continued to reflect adverse factors such as the decline of the U.S. dollar and strong competition in the world market. The Government's dominance of the industry removed the flexibility necessary to react effectively to new market situations. Ferronickel production in Greece practically ceased at a time when its market value rose from $4 to $17 per ton. Aluminium de Grèce S.A., a subsidiary of Pechiney of Prance; the Bodossakis Group (mixed sulfide and lead and zinc concentrates); the Eliopoulos Kyriacopoulos Group (barite, bauxite, bentonite, and perlite); Magnomin General Mining Co. S.A. (magnesite and dead-burned magnesite); and the Titan Cement Co. S.A. remained Greece's major private companies. Major state-owned mineral interests included operations for the production of asbestos, bauxite, cement, chromite, lead, lignite, petroleum and steel.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Bauxite, gross weight thousand tons	2,455	2,296	2,453	2,230	2,400
Alumina, gross weight do	410	482	380	470	480
Metal:					
Primary	136,181	136,244	125,222	126,000	126,000
Secondary[e]	7,000	7,000	7,000	7,000	7,000
Chromium: Chromite:					
Run-of-mine ore	83,202	123,186	214,031	217,979	220,000
Marketable products:					
Direct-shipping ore[e]	7,000	11,000	15,000	[r]16,000	16,000
Concentrate	20,517	50,364	58,948	60,063	63,000
Iron and steel:					
Iron ore and concentrate, nickeliferous:[3]					
Gross weight thousand tons	1,343	1,929	2,245	[e]2,200	2,200
Fe content do	572	810	920	[e]900	900
Metal:					
Pig iron do	138	138	[e]140	[e]160	160
Ferrochromium	[e]18,000	32,974	34,436	38,260	38,000
Ferronickel[e]	50,000	53,000	63,800	[4]10,324	5,000
Steel, crude thousand tons	858	895	985	[e]890	950
Lead:					
Mine output, Pb content[e]	20,000	22,000	20,000	[r]19,000	18,000
Metal, refined, primary[e 5]	--	--	15,000	16,000	16,000
Manganese:					
Ore, crude:					
Gross weight	40,140	28,170	29,820	32,585	35,000
Mn content	12,042	8,451	8,946	10,759	11,500
Concentrate:					
Gross weight	4,636	5,447	5,085	4,560	5,000
Mn conent	2,272	2,669	2,478	2,234	2,450
Nickel:					
Ni content of nickeliferous iron ore[e 6]	13,000	16,700	22,000	[r]14,400	12,000
Ni content of alloys	12,858	15,829	15,952	2,581	1,300
Silver: Mine output, Ag content[e] thousand troy ounces	[4]1,797	1,800	1,700	1,700	1,700
Tin metal, secondary[e]	40	40	40	40	40
Zinc mine output, Zn content[e]	21,300	22,500	21,500	22,500	21,000
INDUSTRIAL MINERALS					
Abrasives, natural: Emery	7,007	8,100	7,729	7,500	8,000
Asbestos:					
Ore thousand tons	2,490	3,766	3,705	3,927	3,700
Processed	31,811	45,376	46,811	51,355	48,000
Barite:					
Crude ore	90,187	24,822	[e]26,000	2,227	3,000
Concentrate	30,262	2,423	3,283	2,305	2,300
Cement, hydraulic thousand tons	14,196	13,521	13,669	13,341	13,400
Clays:					
Bentonite:					
Crude	688,941	778,722	886,972	1,317,825	1,200,000
Processed	214,193	260,941	239,861	352,587	300,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Clays —Continued					
Kaolin:					
Crude	60,749	92,407	87,623	141,210	145,000
Processed	6,032	10,376	7,449	3,532	3,700
Fluorspar, grade unspecified[e]	300	300	300	300	300
Gypsum and anhydrite[e]	[4]645,431	690,000	690,000	650,000	650,000
Magnesite:					
Crude thousand tons	891	1,064	846	944	910
Dead-burned	251,692	316,119	239,837	248,114	220,000
Caustic-calcined	113,026	121,227	94,866	126,069	120,000
Nitrogen: N content of ammonia[e]	[4]227,247	230,000	230,000	230,000	230,000
Perlite:					
Crude	206,882	274,360	239,768	357,347	300,000
Screened	151,601	177,571	161,161	184,148	170,000
Pozzolan (Santorin earth) thousand tons	[r]800	908	938	1,005	1,000
Pumice	500,460	626,971	620,328	860,047	625,000
Pyrites, gross weight	143,518	164,949	173,262	150,245	[4]149,072
Salt, all types thousand tons	159	133	150	[e]150	150
Silica (probably silica sand)[e]	[4]1,908	[4]38,892	38,000	38,000	38,000
Sodium compounds:[e]					
Carbonate	1,000	1,000	1,000	1,000	1,000
Sulfate	[4]7,173	9,000	9,000	[r]8,000	7,000
Stone: Marble[e] cubic meters	[4]138,492	[4]132,332	150,000	150,000	150,000
Sulfur:[e]					
S content of pyrites thousand tons	[4]67	[4]78	78	[r]66	70
Byproduct of petroleum do.	[4]5	[4]5	5	5	5
Natural gas do.	115	120	120	[r]130	130
Total do.	187	203	203	[r]201	205
Talc and steatite	2,166	1,712	1,725	17,310	1,800
MINERAL FUELS AND RELATED MATERIALS					
Coal including briquets:					
Lignite thousand tons	30,580	31,576	35,962	37,976	[4]43,100
Lignite briquets[e] do.	[4]52	120	120	110	120
Coke:[e]					
Coke oven do.	300	300	300	305	305
Gashouse do.	15	15	15	16	18
Gas:					
Manufactured, gasworks[e] million cubic feet	15	15	15	15	15
Natural do.	[e]5,000	3,224	2,195	[e]2,200	2,200
Petroleum:					
Crude thousand 42-gallon barrels	[e]10,000	9,688	9,655	[e]9,500	9,600
Refinery products:					
Gasoline do.	[e]14,500	14,136	16,592	[e]15,000	16,000
Jet fuel do.	[e]13,000	11,696	10,984	[e]11,000	11,000
Kerosene do.	[e]300	217	302	[e]300	300
Distillate fuel oil do.	[e]29,000	28,378	24,521	[e]25,000	26,000
Residual fuel oil do.	[e]35,000	29,417	27,279	[e]28,000	28,000
Lubricants do.	[e]650	630	822	[e]800	800
Other do.	[e]3,400	3,852	3,461	[e]3,500	3,500
Refinery fuel and losses do.	[e]4,500	3,521	3,899	[e]4,000	4,000
Total do.	[e]100,350	91,847	87,860	[e]87,600	89,600

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

[1]Table includes data available through July, 1988.

[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]Ni content is also reported under "Nickel."

[4]Reported figure.

[5]Includes antimonial lead and hard lead.

[6]Also includes Co content.

TRADE

In 1987, Greece's total exports and imports both rose by 24% compared with those of 1986. The foreign debt remained at $17.7 billion, while the debt-service ratio, as a percent of exports, increased from 52% in 1986 to 59% in 1987. Principal U.S. mineral exports to Greece were coal and shredded iron and steel; principal imports were petroleum refinery products, hydraulic cement, and sheet steel. Greece continued to expand commercial contacts with the Council for Mutual Economic Assistance countries in the field of fossil fuels and metals. Within the EEC, Greece participated in the Integrated Mediterranean Program, an EEC development fund that would provide the capital required for some of the country's mineral projects.

Table 2.—Greece: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate thousand tons	1,333	1,133	--	U.S.S.R. 398; Netherlands 151; France 113.
Oxides and hydroxides	187,400	135,565	--	Netherlands 44,050; United Kingdom 24,000; Egypt 23,511.
Ash and residue containing aluminum	610	238	--	Italy 175; United Kingdom 42; Netherlands 21.
Metal including alloys:				
Scrap	1,114	317	--	Italy 115; West Germany 94; Belgium-Luxembourg 67.
Unwrought	43,198	45,855	--	Italy 23,067; France 14,491; Lebanon 1,992.
Semimanufactures	49,549	39,118	5,677	Saudi Arabia 7,666; West Germany 6,372.
Antimony: Ore and concentrate	120	60	--	All to France.
Chromium:				
Ore and concentrate	8,830	10,964	--	West Germany 8,000; United Kingdom 1,044; Spain 80.
Metal including alloys, all forms	209	216	--	All to Netherlands.
Copper:				
Matte and speiss including cement copper	950	1,393	--	Belgium-Luxembourg 713; West Germany 572; Netherlands 102.
Ash and residue containing copper	1,117	547	--	West Germany 350; Spain 184; Belgium-Luxembourg 13.
Metal including alloys:				
Scrap	900	76	--	Belgium-Luxembourg 40; Spain 36.
Unwrought	22	21	--	All to Belgium-Luxembourg.
Semimanufactures	14,481	22,013	159	Italy 9,285; West Germany 2,301; Egypt 2,187.
Gold:				
Waste and sweepings value, thousands	--	$155	--	All to Belgium-Luxembourg.
Metal including alloys, unwrought and partly wrought do.	$218	$87	--	Italy $39; Belgium-Luxembourg $30; West Germany $18.
Iron and steel: Metal:				
Scrap	1,102	1,156	--	Italy 900; Belgium-Luxembourg 191; West Germany 65.
Ferroalloys:				
Ferrochromium	23,070	43,315	8,120	Japan 7,226; Belgium Luxembourg 6,500.
Ferromanganese	--	10	--	All to Belgium-Luxembourg.
Ferronickel	89,542	67,113	--	West Germany 36,093; United Kingdom 9,366; France 8,276.
Steel, primary forms	145,609	152,582	--	Turkey 48,901; Italy 34,928; China 22,544.
Semimanufactures:				
Bars, rods, angles, shapes, sections	246,678	312,392	--	Italy 89,053; Algeria 48,412; China 41,610.
Universals, plates, sheets	154,802	149,470	37,849	Belgium-Luxembourg 26,822; Italy 15,547.
Hoop and strip	53,548	28,837	1,391	Syria 16,382; West Germany 3,115; France 3,106.

See footnote at end of table.

Table 2.—Greece: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel: Metal —Continued				
Semimanufactures —Continued				
Rails and accessories	9	--	--	
Wire	1,474	7,334	--	Saudi Arabia 4,544; Libya 1,291.
Tubes, pipes, fittings	106,032	70,365	8,824	U.S.S.R. 38,598; Cyprus 4,509.
Castings and forgings, rough	252	270	--	Libya 133; West Germany 99; Sweden 24.
Lead:				
Ore and concentrate	23,000	38,800	--	Yugoslavia 19,300; Belgium-Luxembourg 12,500; U.S.S.R. 3,000.
Ash and residue containing lead	982	328	--	All to Spain.
Metal including alloys:				
Scrap	--	1	--	All to Cyprus.
Unwrought	2,167	3,442	--	Italy 1,503; West Germany 1,350; Egypt 500.
Semimanufactures	23	31	--	United Kingdom 19; Libya 11.
Magnesium: Metal including alloys, scrap	30	30	--	Italy 13; West Germany 12; Belgium-Luxembourg 5.
Manganese:				
Ore and concentrate, metallurgical-grade	--	501	--	Saudi Arabia 500; West Germany 1.
Oxides	--	11,135	298	Belgium-Luxembourg 3,978; U.S.S.R. 2,050; West Germany 994.
Molybdenum: Ore and concentrate	--	17,108	--	All to Netherlands.
Nickel:				
Ash and residue containing nickel	39,121	53,027	35,680	Egypt 15,512; Malta 1,275.
Metal including alloys:				
Scrap	18	--		
Semimanufactures	873	1,002	--	Netherlands 1,001.
Platinum-group metals:				
Waste and sweepings value, thousands	--	$18	$18	
Metals including alloys, unwrought and partly wrought do.	$782	$1,704	--	West Germany $1,070; United Kingdom $4.
Rare-earth metals including alloys, all forms	1	--		
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$4,004	$8,361	--	France $5,708; Belgium-Luxembourg $2,652; Saudi Arabia $1.
Tin:				
Ash and residue containing tin	22	--		
Metal including alloys:				
Scrap	6	--		
Unwrought	1	--		
Semimanufactures	(2)	2	--	West Germany 1; bunkers 1.
Titanium: Metal including alloys, semimanufactures	--	5	--	All to Italy.
Zinc:				
Ore and concentrate	43,300	45,250	--	France 15,000; Belgium-Luxembourg 13,000; Yugoslavia 10,500.
Blue powder	--	35	--	West Germany 29; Egypt 6.
Matte	431	175	--	India 100; Belgium-Luxembourg 50; Italy 25.
Ash and residue containing zinc	1,322	1,526	--	West Germany 816; Belgium-Luxembourg 710.
Metal including alloys:				
Scrap	373	628	--	West Germany 411; Italy 217.
Unwrought	69	1	--	NA.
Semimanufactures	2	188	--	Italy 96; West Germany 88; Saudi Arabia 1.
Other:				
Ores and concentrates	143,390	59,123	4,250	Belgium-Luxembourg 38,868; Sweden 10,000; France 6,000.
Ashes and residues	21,371	20,063	--	New Zealand 12,105; Malta 5,711; United Arab Emirates 3,898.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	373,588	583,519	362,068	United Kingdom 92,539; Algeria 69,665.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$399	$522	$378	West Germany $143.

See footnotes at end of table.

Table 2.—Greece: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Abrasives, n.e.s. —Continued				
Grinding and polishing wheels and stones	37	69	--	Switzerland 37; Iran 19; Turkey 8.
Asbestos, crude	29,387	44,468	--	Turkey 6,235; Italy 4,672; France 3,952.
Barite and witherite	14,000	22,109	--	Kuwait 22,000; Israel 109.
Boron materials: Elemental	--	(2)	--	NA.
Cement thousand tons	7,286	7,315	1,094	Egypt 2,629; Algeria 1,376; Saudi Arabia 1,306.
Chalk	1,652	642	--	Saudi Arabia 477; Bahrain 80; Cyprus 43.
Clays, crude:				
Bentonite	453,714	460,875	--	Sweden 59,008; Netherlands 58,898; West Germany 55,160.
Chamotte earth	1	14	--	All to West Germany.
Kaolin	15,314	27,585	--	Yugoslavia 19,630; Cyprus 7,163; Egypt 500.
Unspecified	187	69	--	All to Cyprus.
Diamond: Gem, not set or strung value, thouands	--	$22	--	All to Japan.
Diatomite and other infusorial earth	15	--		
Feldspar, fluospar, related materials, feldspar	20	100	--	All to Israel.
Fertilizer materials:				
Crude, n.e.s	365	104	--	All to Saudi Arabia.
Manufactured:				
Nitrogenous	11,282	66,444	--	Algeria 23,400; Turkey 13,600; United Kingdom 10,700.
Phosphatic	--	14,950	--	All to Algeria.
Potassic	33,110	58,175	--	China 34,500; Saudi Arabia 6,000; Belgium-Luxembourg 5,000.
Unspecified and mixed	74,399	62,722	--	China 30,750; France 15,875; Cyprus 8,003.
Gypsum and plaster	61	24	16	Egypt 3.
Kyanite and related materials	--	20	--	All to Cyprus.
Lime	500	151	--	Israel 150.
Magnesium compounds:				
Magnesite, crude	10,447	8,054	--	Italy 4,000; Netherlands 1,886; United Kingdom 1,555.
Oxides and hydroxides	332,618	326,871	74,860	West Germany 65,934; United Kingdom 38,538.
Mica: Worked including agglomerated splittings	1	--		
Precious and semiprecious stones other than diamond: Natural value, thousands	--	$22	--	All to Switzerland.
Pyrite, unroasted	110	--		
Salt and brine	11	75	--	West Germany 67; bunkers 8.
Sodium compounds, n.e.s.: Carbonate, manufactured	80	50	--	Cyprus 25; Saudi Arabia 25.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	53,053	39,015	151	Saudi Arabia 12,660; Italy 8,188; West Germany 5,531.
Worked	140,206	173,067	9,317	Saudi Arabia 74,327; Tunisia 27,000; Algeria 17,904.
Dolomite, chiefly refractory-grade	1,300	3,183	--	United Kingdom 2,800; Saudi Arabia 209; Kuwait 59.
Gravel and crushed rock	9,535	3,460	--	Libya 2,505; Cyprus 920; West Germany 15.
Limestone other than dimesion	--	6,830	--	All to Cyprus.
Quartz and quartzite	2,900	18,500	--	Italy 10,000; Switzerland 8,500.
Sand other than metal-bearing	26	33	--	Austria 28; Jordan 9.
Sulfur:				
Elemental, crude including native and byproduct	13,571	7,023	--	Algeria 3,000; Romania 2,500; Cyprus 1,399.
Dioxide	168	148	--	All to Cyprus.
Sulfuric acid	4,708	1,375	--	Lebanon 715; Cyprus 428; Saudi Arabia 128.
Talc, steatite, soapstone, pyrophyllite	109	245	--	All to Cyprus.
Vermiculite, perlite, chlorite	200,764	225,623	52,570	West Germany 88,460; United Kingdom 29,375.

See footnotes at end of table.

Table 2.—Greece: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Other:				
Crude	6,585	3,147	--	France 1,151; Bulgaria 605; United Kingdom 500.
Slag and dross, not metal-bearing	10,855	2,806	--	Saudi Arabia 1,789; Israel 500; West Germany 425.
MINERAL FUELS AND RELATED MATERIALS				
Coal: Bituminous	49,000	--		
Petroleum:				
Crude, thousand 42-gallon barrels	2,728	5,401	--	All to France.
Refinery products:				
Liquefied petroleum gas do	401	390	--	Lebanon 147; Egypt 102; Syria 96.
Gasoline do	4,866	3,327	1,232	France 1,815; Italy 147.
Mineral jelly and wax do	(2)	--		
Kerosene and jet fuel do	3,458	2,979	2,550	Netherlands 221; Egypt 97.
Distillate fuel oil do	1,505	820	192	France 299; Singapore 101.
Lubricants do	697	740	29	Italy 164; Egypt 157; France 53.
Residual fuel oil do	5,744	4,486	652	Bulgaria 1,323; United Arab Emirates 692.
Bitumen and other residues do	1	(2)	--	All to Cyprus.
Bituminous mixtures do	2	3	--	Mainly to Cyprus.
Petroleum coke do	11	--		

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	2,029	563	--	France 265; West Germany 226; Belgium-Luxembourg 53.
Alkaline-earth metals	21	12	--	All from France.
Aluminum:				
Ore and concentrate	1,406	102	--	All from China.
Oxides and hydroxides	332	505	(2)	United Kingdom 240; West Germany 201; Italy 36.
Metal including alloys:				
Scrap	50	69	--	United Arab Emirates 36; Cyprus 32; Yemen (Aden) 1.
Unwrought	3,644	7,180	--	Egypt 2,531; U.S.S.R. 1,464; Canada 1,001.
Semimanufactures	4,627	7,583	8	West Germany 3,247; United Kingdom 2,043; Italy 838.
Antimony:				
Oxides	11	13	--	United Kingdom 9; Switzerland 2; Italy 1.
Metal including alloys, all forms	71	13	--	All from Belgium-Luxembourg.
Arsenic: Oxides and acids	74	51	--	France 38; Belgium-Luxembourg 13.
Bismuth: Metal including alloys, all forms	1	1	--	Mainly from United Kingdom.
Cadmium: Metal including alloys, all forms	1	3	--	Belgium-Luxembourg 1; West Germany 1; Netherlands 1.
Chromium:				
Ore and concentrate	35,980	65,152	--	Albania 38,764; Republic of South Africa 18,628; Turkey 5,487.
Oxides and hydroxides	208	84	--	United Kingdom 59; West Germany 20; Romania 5.
Metal including alloys, all forms	--	(2)	--	Mainly from Belgium-Luxembourg.
Cobalt:				
Oxides and hydroxides	(2)	--		
Metal including alloys, all forms	5	8	1	Belgium-Luxembourg 3; West Germany 3.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Columbium and tantalum: Metal including alloys, all forms:				
Columbium (niobium)	(2)	--		
Tantalum	(2)	--		
Copper:				
Matte and speiss including cement copper	9,959	12,486	--	Chile 3,575; Belgium-Luxembourg 2,811; Zambia 1,504.
Oxides and hydroxides	92	39	--	Norway 24; West Germany 10; Austria 4.
Sulfate	1,373	872	6	Yugoslavia 849; East Germany 10.
Metal including alloys:				
Scrap	(2)	9	--	Yemen (Aden) 7; West Germany 1.
Unwrought	22,780	28,346	(2)	Chile 14,786; Zambia 5,188; Spain 2,225.
Semimanufactures	8,539	4,092	10	West Germany 1,014; Belgium-Luxembourg 910; France 615.
Gold: Metal including alloys, unwrought and partly wrought value, thousands	$25,872	$29,087	$37	Switzerland $26,135; West Germany $2,522; Austria $317.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasting pyrite	339	2,038	--	China 1,772; Sweden 195; Netherlands 40.
Pyrite, roasted	14,950	--		
Metal:				
Scrap	313,312	455,305	130,595	U.S.S.R. 130,189; United Kingdom 62,518.
Pig iron, cast iron, related materials	8,589	20,335	22	U.S.S.R. 17,895; France 954; Yugoslavia 757.
Ferroalloys:				
Ferrochromium	43	46	--	West Germany 39; Sweden 6; France 1.
Ferromanganese	6,115	5,296	--	Portugal 2,824; Belgium-Luxembourg 1,393; Republic of South Africa 352.
Ferromolybdenum	6	8	--	Austria 3; West Germany 2; Italy 2.
Ferrosilicomanganese	6,642	6,525	--	Portugal 5,514; Spain 306; Republic of South Africa 189.
Ferrosilicon	2,807	3,901	--	France 1,281; West Germany 1,046; Norway 740.
Silicon metal	311	622	--	France 563; Italy 24; Norway 15.
Unspecified	424	397	(2)	France 265; Belgium-Luxembourg 62; Netherlands 38.
Steel, primary forms	943,412	958,607	--	Netherlands 261,457; United Kingdom 188,303; France 106,600.
Semimanufactures:				
Bars, rods, angles, shapes, sections	169,753	231,801	5	Italy 37,793; France 31,527; Yugoslavia 29,956.
Universals, plates, sheets	212,826	181,224	458	France 32,183; West Germany 27,570; Italy 16,625.
Hoop and strip	22,363	21,367	(2)	Bulgaria 7,600; West Germany 5,002; Belgium-Luxembourg 4,439.
Rails and accessories	1,104	19,912	--	Austria 10,376; France 4,291; West Germany 4,109.
Wire	10,874	13,042	(2)	Italy 2,489; West Germany 1,802; Belgium-Luxembourg 1,621.
Tubes, pipes, fittings	29,664	27,825	167	West Germany 9,100; Republic of South Africa 3,382; Italy 3,034.
Castings and forgings, rough	985	894	43	Italy 342; Belgium-Luxembourg 202; West Germany 168.
Lead:				
Ore and concentrate	9,783	9,009	--	Peru 3,342; Iran 2,850; Morocco 2,000.
Oxides	82	114	--	France 69; United Kingdom 38; West Germany 5.
Ash and residue containing lead	2	--		
Metal including alloys:				
Scrap	12	65	--	West Germany 49; Sweden 15.
Unwrought	9,752	1,937	--	Australia 972; West Germany 411; Belgium-Luxembourg 346.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Lead —Continued				
Metal including alloys —Continued				
Semimanufactures	22	99	--	Italy 62; West Germany 16; United Kingdom 8.
Lithium: Oxides and hydroxides	3	48	--	France 30; United Kingdom 12; West Germany 6.
Magnesium: Metal including alloys:				
Unwrought	382	550	--	Norway 276; France 272; United Kingdom 2.
Semimanufactures	18	20	(2)	West Germany 14; France 6.
Manganese:				
Ore and concentrate, metallurgical-grade	10,852	589	--	All from Turkey.
Oxides	5	133	--	Belgium-Luxembourg 102; France 15; Netherlands 15.
Metal including alloys, all forms	119	138	--	Belgium-Luxembourg 32; France 31; United Kingdom 31.
Mercury 76-pound flasks	58	116	NA	West Germany 58; France 29; United Kingdom 20.
Molybdenum: Metal including alloys:				
Unwrought	3	35	(2)	U.S.S.R. 14; France 13; West Germany 4.
Semimanufactures	11	3	(2)	West Germany 2.
Nickel:				
Ore and concentrate	--	2,896	--	All from Albania.
Matte and speiss	207	--		
Oxides and hydroxides	4	--		
Metal including alloys:				
Scrap	--	61	--	United Kingdom 60; Netherlands 1.
Unwrought	134	120	(2)	Republic of South Africa 45; Canada 38; Belgium-Luxembourg 12.
Semimanufactures	34	45	(2)	West Germany 17; Italy 10; Hungary 5.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$1,421	$1,519	$360	Switzerland $735; West Germany $324.
Rare-earth metals including alloys, all forms	--	2	--	All from Italy.
Selenium, elemental	(2)	1	--	All from Switzerland.
Silicon, high-purity	213	44	--	All from France.
Silver:				
Waste and sweepings value, thousands	$1	--		
Metal including alloys, unwrought and partly wrought do	$4,786	$9,954	$8	Netherlands $5,911; Switzerland $2,304; West Germany $1,354.
Tellurium, elemental and arsenic	--	(2)	--	All from West Germany.
Tin:				
Oxides	5	10	--	Italy 7; United Kingdom 3.
Metal including alloys:				
Scrap	1	2	--	All from West Germany.
Unwrought	417	479	1	Malaysia 185; Brazil 168; Netherlands 57.
Semimanufactures	26	54	5	West Germany 26; Belgium-Luxembourg 10; United Kingdom 8.
Titanium:				
Ore and concentrate	299	233	--	Austria 199; Australia 20; Netherlands 14.
Oxides	357	174	--	Belgium-Luxembourg 60; West Germany 52; France 45.
Metal including alloys, semimanufactures	(2)	7	--	Italy 4; Switzerland 2; West Germany 1.
Tungsten: Metal including alloys:				
Unwrought	1	2	--	West Germany 1.
Semimanufactures	(2)	1	--	Mainly from Netherlands.
Uranium and/or thorium:				
Ore and concentrate	(2)	--		
Metal including alloys, all forms, thorium	--	(2)	(2)	Do.
Vanadium:				
Oxides and hydroxides	--	5	--	All from Netherlands.
Metal including alloys, unwrought	--	(2)		All from West Germany.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Zinc:				
Oxides	472	813	1	France 310; West Germany 238; Netherlands 94.
Blue powder	8	108	--	West Germany 93; Belgium-Luxembourg 14.
Metal including alloys:				
Scrap	40	--		
Unwrought	17,344	16,764	--	Belgium-Luxembourg 6,581; Netherlands 5,013; West Germany 993.
Semimanufactures	112	93	1	West Germany 35; Yugoslavia 20; Belgium-Luxembourg 18.
Zirconium:				
Ore and concentrate	216	234	--	United Kingdom 144; Austria 40; West Germany 30.
Metal including alloys, semimanufactures	(2)	(2)	(2)	
Other:				
Ores and concentrates	3,562	6,866	--	China 6,101; Australia 487; Sweden 150.
Oxides and hydroxides	14	5	--	All from Italy.
Ashes and residues	--	5,750	--	Do.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	40	391	12	Yugoslavia 336; Italy 42.
Artificial:				
Corundum	272	271	--	West Germany 160; Brazil 36; Italy 23.
Silicon carbide	961	1,228	5	West Germany 979; Italy 151; Netherlands 35.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$3,446	$3,811	--	West Germany $2,826; Belgium-Luxembourg $444; Ireland $238.
Grinding and polishing wheels and stones	668	616	1	Italy 373; West Germany 71; Austria 46.
Asbestos, crude	4,653	1,271	--	Republic of South Africa 1,063; Cyprus 172; Canada 36.
Barite and witherite	2,590	5,175	--	West Germany 5,055; Turkey 120.
Boron materials:				
Crude natural borates	--	34	--	All from Italy.
Oxides and acids	59	170	--	Turkey 140; Italy 12; France 10.
Cement	784	522	--	Spain 328; Denmark 105; Netherlands 60.
Chalk	90	(2)	--	All from Italy.
Clays, crude:				
Bentonite	359	370	43	Netherlands 108; United Kingdom 82; West Germany 69.
Chamotte earth	3,076	3,317	--	China 2,017; Israel 925; Sweden 158.
Fuller's earth	--	7	--	France 5; Austria 2.
Kaolin	41,180	52,866	181	United Kingdom 42,114; Bulgaria 2,617; France 1,523.
Unspecified	10,929	8,347	--	United Kingdom 4,290; Italy 1,512; unspecified 2,540.
Cryolite and chiolite	2	12	--	Denmark 10; Italy 2.
Diamond:				
Gem, not set or strung value, thousands	$187	$224	$11	Belgium-Luxembourg $138; Hong Kong $25; France $21.
Industrial stones do	$420	$479	--	West Germany $329; Belgium-Luxembourg $150.
Diatomite and other infusorial earth	1,693	2,145	766	United Kingdom 722; Denmark 197.
Feldspar, fluorspar, related materials:				
Feldspar	1,530	4,446	--	Norway 2,210; Italy 1,341; United Kingdom 115.
Fluorspar	9,642	11,720	--	Kenya 11,683; France 37.
Unspecified	3,097	5,743	--	Norway 5,489; West Germany 159; Switzerland 94.
Fertilizer materials:				
Crude, n.e.s	--	6	--	All from Italy.
Manufactured:				
Ammonia	129,174	179,525	1	Italy 60,690; West Germany 18,533; U.S.S.R. 16,245.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Fertilizer materials —Continued				
Manufactured —Continued				
Nitrogenous	159,718	180,471	--	Italy 75,723; Bulgaria 36,259; Poland 24,940.
Phosphatic	18	1,005	--	All from West Germany.
Potassic	57,802	58,026	--	West Germany 24,125; Belgium-Luxembourg 10,477; Italy 10,349.
Unspecified and mixed	12,221	7,413	98	West Germany 3,505; Italy 2,759; Belgium-Luxembourg 613.
Graphite, natural	765	--		
Gypsum and plaster	914	1,423	34	Italy 1,042; West Germany 341.
Iodine	1	2	--	West Germany 1; Netherlands 1.
Kyanite and related materials	201	1,874	1	Netherlands 1,455; United Kingdom 214; West Germany 145.
Lime	62	122	--	West Germany 62; Turkey 60.
Magnesium compounds:				
Magnesite, crude	--	5,743	--	Turkey 5,741; France 2.
Oxides and hydroxides	27,024	18,798	1	Turkey 18,398; Austria 230; West Germany 56.
Other	38	20	--	All from Italy.
Mica:				
Crude including splittings and waste	474	514	--	Austria 407; Turkey 46; Switzerland 24.
Worked including agglomerated splittings	5	5	--	Spain 3; West Germany 1; United Kingdom 1.
Nitrates, crude	40	80	--	All from Belgium-Luxembourg.
Phosphates, crude	202,830	356,999	--	Tunisia 119,126; Senegal 117,507; Morocco 93,671.
Phosphorus, elemental	6	3	--	All from Sweden.
Pigments, mineral:				
Natural, crude	85	--		
Iron oxides and hydroxides, processed	1,265	1,158	--	West Germany 816; Spain 105; Italy 78.
Potassium salts, crude	--	7,831	--	All from France.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$172	$168	$4	Thailand $61; Belgium-Luxembourg $15; Israel $14.
Synthetic do.	$22	$65	--	Thailand $42; West Germany $11; Austria $7.
Pyrite, unroasted	41,354	19,082	--	All from Spain.
Salt and brine	48,873	68,321	--	Italy 50,430; Spain 11,118; Egypt 2,641.
Sodium compounds, n.e.s.: Carbonate, manufactured	35,009	32,660	--	Italy 10,720; Turkey 5,441; Belgium-Luxembourg 4,489.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	1,808	1,143	--	Pakistan 419; Turkey 331; Italy 150.
Worked	320	239	(2)	Italy 132; Yugoslavia 65; West Germany 19.
Dolomite, chiefly refractory-grade	473	2,038	--	United Kingdom 1,727; West Germany 139; Italy 129.
Gravel and crushed rock	1,039	2,336	--	Belgium-Luxembourg 1,619; France 204; Italy 190.
Limestone other than dimension	(2)	--		
Quartz and quartzite	123	126	--	France 44; United Kingdom 40; West Germany 23.
Sand other than metal-bearing	75,897	97,052	1	Belgium-Luxembourg 40,797; Bulgaria 18,473; Albania 12,116.
Sulfur:				
Elemental:				
Crude including native and byproduct	46,749	101,073	--	Poland 68,215; France 32,837; Belgium-Luxembourg 10.
Colloidal, precipitated, sublimed	43	81	--	West Germany 65; France 16.
Dioxide	1	2	--	West Germany 1; Netherlands 1.
Sulfuric acid	34,258	23,828	--	Italy 20,701; Japan 3,086; Netherlands 18.
Talc, steatite, soapstone, pyrophyllite	2,036	2,509	53	Finland 767; Austria 408; France 342.
Vermiculite, perlite, chlorite	248	221	--	Italy 106; Republic of South Africa 95; China 20.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Other:				
Crude	643	1,147	21	Belgium-Luxembourg 561; West Germany 191; Italy 149.
Slag and dross, not metal-bearing	209,443	434,509	--	Italy 35,702; France 50,674; Spain 25,310.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	3	42	--	United Kingdom 23; Belgium-Luxembourg 19.
Carbon:				
Carbon black	4,447	4,552	21	Italy 3,765; Romania 261; West Germany 233.
Gas carbon	1,133	2,718	--	Italy 2,301; West Germany 262; East Germany 95.
Coal:				
Anthracite	18	9,295	9,295	
Bituminous	1,549,893	1,832,852	751,987	Australia 588,472; Colombia 250,611.
Briquets of anthracite and bituminous coal	--	68,136	33,043	Australia 34,000; Czechoslovakia 93.
Lignite including briquets	2	3	--	Netherlands 2; West Germany 1.
Coke and semicoke	84,209	72,588	--	Japan 21,884; Italy 20,809; Egypt 10,384.
Peat including briquets and litter	10,262	10,495	--	U.S.S.R. 6,195; West Germany 1,569; Netherlands 1,167.
Petroleum:				
Crude, thousand 42-gallon barrels	91,409	77,526	--	Saudi Arabia 35,388; Libya 17,277; U.S.S.R. 9,010.
Refinery products:				
Liquefied petroleum gas do	26	27	(2)	France 15; Italy 8; West Germany 4.
Gasoline do	1,165	1,162	(2)	Saudi Arabia 297; Italy 251; Romania 213.
Mineral jelly and wax do	29	29	(2)	West Germany 12; Israel 7; Hungary 3.
Kerosene and jet fuel do	154	56	(2)	Italy 53; West Germany 1; Netherlands 1.
Distillate fuel oil do	839	409	(2)	Bulgaria 144; Italy 105; U.S.S.R. 75.
Lubricants do	633	886	3	Italy 367; Netherlands 363.
Residual fuel oil do	5,978	4,086	318	Iraq 2,472; Saudi Arabia 387.
Bitumen and other residues do	454	410	--	Albania 267; Italy 95; Spain 30.
Bituminous mixtures do	7	1	(2)	Mainly from Italy.
Petroleum coke do	344	578	387	U.S.S.R. 186; West Germany 4.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—In preparation for the planned Greek-Soviet alumina plant, the Bauxites Parnasse Mining Co. S.A., a subsidiary of the Eliopoulos Kyriacopoulos Group and Greece's largest bauxite producer, completed a $3.5 million beneficiation plant and increased production and sales from 1.37 and 1.23 million tons, respectively, in 1986 to 1.45 and 1.31 million tons, respectively, in 1987. The company planned to expand mining capacity to supply about two-thirds of the proposed plant's feed requirements by startup of operations in the early 1990's.

The Governments of Greece and the Soviet Union signed an agreement in April 1987 to resolve a number of pending issues in the planned alumina project. Under the terms of this agreement, the Soviet Union would purchase the entire output of the future plant. Moreover, the Soviet Union would be obliged to pay 70% of the value of the alumina in hard currency; 30% of the value would be covered by obligatory Greek purchases of machinery and equipment from the U.S.S.R. needed to operate the plant. Earlier, the Soviet Union agreed to purchase only 380,000 tons of alumina per year over a 10-year period; but following Greece's failure in 1986 and early 1987 to reach a long-term future sales agreement with Bulgaria for 220,000 tons of alumina per year, the Soviet Government announced it was willing to purchase all future alumina output from the proposed plant over a 10-year period. The price of the alumina would be based on an average basket of world producer prices, and linked to free-market quotations. A newly formed subsidiary of the Hellenic Industrial Development Bank (ETVA), Greek Alumina S.A. (ELVA) was designated to manage and operate the plant project. Soviet foreign trade organizations, Tsvetmetpromexport and Raznoimport, would be involved in the supply of equipment and services, respectively, to the alumina project and buy the product.

Under pressure from Greece's environmental and cultural interests, the planned site of the alumina plant was relocated from the historic and archaeologically important Delphi area to Boeotia. Construction management for the project would be carried out by Kaiser Engineers and Constructors of the United States. Outstanding issues concerning the alumina plant at yearend included the need to acquire funds for subsidiary equipment, for infrastructure on the plant site, and for the construction of water-proofed enclosures for red mud.

Chromite.—Late in the year, Hellenic Ferroalloys S.A. announced the construction startup of a new concentrator to raise chromite concentrate production capacity from 60,000 to 120,000 tons per year. Expansion of mine capacity to provide the necessary feed was also begun, and the new facilities were to be operating by late 1988. However, the actual operational startup would depend on a decision on whether to switch over Larco's idle ferronickel capacities to ferrochromium production, or to add entirely new ferrochromium furnaces at the Tsingali ferrochromium plant. By yearend, the issue was still unresolved.

Iron and Steel.—The decision to build a stainless steel plant was again held in abeyance in 1987, owing partly to uncertainty over Larco's future. The original project envisaged a 60,000-ton-per-year plant with smelting, slab casting, and cold-rolling strip facilities.

In 1987, Greek steelmakers charged Bulgaria and Yugoslavia with dumping long and flat-rolled steel products on the Greek market. The Government of Greece had reportedly initiated an inquiry into these allegations during the year, but it did not refer this issue to the EEC for investigation. Reportedly, only Bulgaria had an import-penetration agreement for steel products with the EEC. Yugoslavia's past attempt to reach a similar agreement was blocked by EEC mill operators who felt that the enforcement of antidumping regulations was a more effective method of lowering imports.

The rising cost of electricity was another problem the Greek steel industry faced during the year. To remain competitive, the industry requested a 30% cut in its electric power debt during the year. In midyear, an Athens court granted the Government-owned Public Power Corp. (PPC) the right to seize the property and assets of Metallurgiki Halyps S.A. steelworks for outstanding electric power debts from 1983 to 1986. Reportedly, despite appeals from the plant's personnel and parliamentary representative, the Government refused to assist the steelworks, leading to fears of impending

closure.[4] In past years, the PPC had been implicated in a variety of irregularities concerning overcharging customers. The suit brought against the PPC by Aluminium de Gréce in 1985 for arbitrary overcharging was still to be resolved.

Lead and Zinc.—After a 2-year delay, Aegean Metallurgical Industries S.A. proceeded with plans to construct the initial phase of a lead and zinc mining-and-processing complex at Molai in the Peloponnese. The first project in the initial phase was to be a gold and silver processing unit for high-arsenic pyrite from the Olympias Mine in Khalkidiki. The plant would produce 5 tons of silver, 3 tons of gold, and 330,000 tons of sulfuric acid and arsenic trioxide per year. The second and third phases of the lead-zinc complex would include the development of four mines and the construction of four concentrators. However, by yearend, the construction and development startup schedules remained open.

Nickel.—Since coming under state control in 1985, Larco's difficulties continued to mount. The company's debt doubled to about $220 million, of which a substantial but disputed share was owed to the PPC. Larco's management indicated that the company's debt was no more than 33% of the $200 million owed the PPC, and appealed to the Government for adjudication. In both 1985 and 1986, Larco, Greece's sole producer of ferronickel, was disrupted by strikes and work stoppages that resulted in extended production losses. The strikes were in response to proposed labor cutbacks to maintain competitiveness during a decline in world nickel prices. Larco's management indicated that the company's break-even point was $2.40 to $2.45 per pound of nickel while market prices were $2.20 per pound or less. The company had resumed normal operations by yearend 1986, after winning concessions to cut back the labor force from 2,000 to 1,200 employees, but by mid-1987, the Government decided to sell Larco at a public auction. The company reportedly was operating profitably owing to an improvement in nickel prices. The auction was postponed several times during the year, and in December, it was put off until mid-1988. Other issues that remained unresolved were whether to transfer some of Larco's electric-furnace capacity for the production of ferrochromium under the auspices of Hellenic Ferroalloys S.A., and also, whether there will be a stainless steel capacity to use domestically produced ferroalloys.

Scrap.—Late in the year, construction was started on the infrastructure for Navipe, a major shipbreaking facility at Astakos on Greece's west coast. The startup of the new operation was scheduled for 1988 with a total capacity of 310,000 tons per year. The development of the second stage of the new Navipe facility would include the addition of rolling mills, nonferrous metals remelting units, and foundries. The Navipe shipbreaking project was planned and financed under the auspices of ETVA and the EEC's Integrated Mediterranean Program. The Greek Shipbreakers Association reacted negatively to the project, claiming that ETVA's 1983 feasibility study was outdated because of lower world prices for scrap and the reduction of offers of ships for breakage. The Shipbreakers Association also noted that while existing private yards were already struggling to survive, scrap from the new Navipe facility would have to be trucked to the steel industries at the opposite end of the country, which would necessitate subsidies.

INDUSTRIAL MINERALS

Greece continued to be a substantial world and EEC producer of a wide range of industrial minerals that included asbestos, barite, bentonite, cement, emery, feldspar, gypsum, kaolin, limestone. magnesite, marble, quartz, sulfur, and talc.

Greece was the 15th largest producer of cement in the world and the third largest exporter. It was also the only country in the world to export more cement than it consumed domestically.[5] From 1981, the first year of the current Government, through 1986, exports exceeded consumption by 2%, 9%, 24%, 20%, 28%, and 15%, respectively, owing to Government policies that kept domestic prices below production costs. In 1987, Heracles Cement S.A. invited bids on the delivery of about 500,000 tons of coal in 1988 to its operations in Greece. In mid-December, U.S. coal exporters indicated an inability to compete with cheaper coal from Australia, the Republic of South Africa, and Colombia to supply Heracles.

MINERAL FUELS

Greece maintained an energy policy based on the reduction of imported petroleum and its substitution by domestic sources of lignite, and where possible, by hydroelectric power and domestic production of petroleum and natural gas. In 1986, petroleum's share of total energy consumption was

about 58% as opposed to 76% in 1973. Apart from lignite, the country had few domestic sources of energy; its only indigenous source of petroleum was the small offshore deposit at Prinos in the northern Aegean area. Output at this site has been about 1.3 million tons per year. The associated South Kevala Gasfield maintained a modest output that was used largely for fertilizer production and to boost petroleum recovery. Both fields were operated by NAPC, a consortium led by Denison Mines of Canada.

In 1987, a dispute arose between the Governments of Greece and Turkey over petroleum exploration rights in the Aegean. Although the issue was resolved, the Government of Greece drafted legislation to nationalize NAPC and take over drilling and exploration. The legislation was appealed by the consortium owners to the courts, which ruled it to be unconstitutional. In subsequent negotiations, the Government agreed to let the consortium operate privately, but was assured state control over exploration and drilling programs.

In October, the Governments of Greece and the U.S.S.R. signed a memorandum of understanding for long-term purchases of natural gas from the Soviet Union. The agreement stipulated the construction of a 437-mile spur line to Greece, from the Soviet-Bulgarian gas trunk, that would transport a proposed minimum 35 billion cubic feet of natural gas per year for 25 years. The spur line would be completed by 1992 and would cost approximately $1 billion. It would have sufficient capacity to convey more than 70 billion cubic feet of gas per year. Issues concerning financing, price, and method of payment for purchased gas were to be resolved in separate negotiated agreements between the Soviet foreign trade organization, Soyouzgazexport, and the Public Petroleum Corp. of Greece. Part of the gas would fuel the new alumina plant.

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[1]Foreign mineral specialist. Division of International Minerals.
[2]Greece's Weekly. Mar. 28, 1988, pp. 5-8.
[3]Journal of Commerce. Sept. 28, 1987, p. 3A.
[4]Metals Bulletin. Aug. 6, 1987, p. 4.
[5]Ciments et Chaux. Nov. 1987, pp. 15-16.

The Mineral Industry of Guinea

By Michael D. Fenton[1]

The Republic of Guinea continued to effect changes in economic and administrative policy that eventually would decrease the role of the Government in the economy and develop the country's mineral and agricultural potential. Toward these ends, the Government reformed the country's monetary and banking system and promulgated new petroleum, mining, commercial, and investment codes to attract foreign investment in, among others, the mining industry. There is long-term potential for investment in the mining sector, primarily in gold and diamonds.

In early 1987, foreign donors agreed to provide the $670 million requested by the Government for its recently drafted 1987-88 public investment program and $200 million in balance of payments support for 1988-89, made necessary by the sharp fall in bauxite prices. The donors included the African Development Bank, the Islamic Development Bank, the International Monetary Fund, the International Bank for Reconstruction and Development (World Bank), Canada, France, the Federal Republic of Germany, Italy, Japan, Saudi Arabia, Switzerland, and the United States. The main priority was to develop basic infrastructure, especially roads, while mining, industry, energy, and water sectors would receive the remaining 18.7% of the funds.

The Government planned to reduce its dependence on bauxite revenues by diversifying into diamond, gold, and iron ore mining. At present, Guinea depends on bauxite and alumina for 80% to 90% of its export revenues. As a proportion of the value of total exports, bauxite exports were forecast to fall from 87% to 63%, while gold exports would increase eightfold to nearly $100 million, and diamond exports would increase by 33% to $48 million. The Government made little progress toward the development of the rich Nimba iron ore deposits on the Guinean side of the Liberian border at Mount Nimba.

PRODUCTION AND TRADE

Guinea had the world's largest bauxite reserves, amounting to 5.9 billion tons or one-quarter of the world total, and it was the world's second largest exporter of bauxite after Australia. Total production was an estimated 14.2 million tons. The amounts of metallurgical-grade and calcined bauxite shipped were about 11.4 million tons and 138,000 tons, respectively. Guinea remained extremely dependent on mining exports for Government revenue and for foreign exchange earnings.

Compagnie des Bauxites de Guinée (CBG) produced 9.7 million tons of bauxite from its Sangaredi Mine during 1987, its 15th year of production. Of this total, 120,000 tons was calcined. CBG production was sold to European and North American shareholders in Pittsburgh-based Halco Mining Inc. The decline in growth in aluminum consumption and the resulting decline in demand and price for bauxite brought about a renegotiation of the CBG export agreement. Since CBG provided nearly two-thirds of Government revenue and about 60% of export earnings, the depressed world market for bauxite had a serious impact on the Guinean economy.

Two other bauxite mines, at Kindia and Fria, produced about 4.5 million tons. About 90% of Kindia bauxite was exported to the U.S.S.R. for debt repayment, while the remainder went to Eastern Europe. Alumina production from Fria, nearly 543,000 tons, was exported to Canada and Western Europe.

Diamond production at the Aredor diamond mine fell 14% from 203,795 carats in 1986 to 174,916 carats in 1987. Nevertheless, the mine may be the world's richest in terms of average price per carat received for its production, of which 93% is gem quality. The average stone size also has been exceptionally high. In January 1987, a 100.3 carat diamond was mined and later sold for a record-high price of $1.56 million. An even larger 143-carat gem was found, which was sold in October for $3.65 million in an Antwerp auction. Total revenues for 1987 were an estimated $60 million.[2]

Gold was mined by artisans on a small scale and sold clandestinely. The Central Bank of Guinea authorized commercial banks to purchase gold on its behalf from anonymous sellers. Other than this unreported production, which was not well known, the Aredor diamond mine produced 2,380 troy ounces of byproduct gold in 1987.

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

(Thousand metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987
Aluminum:					
Bauxite:					
Mine production:					
Wet basis ---- thousand tons	12,421	14,156	13,100	14,423	14,600
Dry basis ---- do.	11,600	12,740	11,790	13,300	13,500
Shipments (dry basis):					
Metallurgical-grade bauxite ---- do.	r10,380	11,310	11,084	11,469	11,500
Calcined bauxite ---- do.	100	120	100	122	3138
Alumina:					
Production ---- do.	r573	578	572	556	556
Shipments ---- do.	r573	578	572	556	556
Diamond:					
Gem ---- thousand carats	e23	44	123	190	3163
Industrial ---- do.	e17	3	9	14	312
Total ---- do.	e40	47	132	204	3175

eEstimated. rRevised.

[1]Includes data available through July 7, 1988.

[2]In addition to the commodities listed, modest quantities of unlisted varieties of crude construction materials (clays, sand and gravel, and stone) presumably are produced, but output is not reported quantitatively, and available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

COMMODITY REVIEW

METALS

Bauxite and Alumina.—Negotiations between the Government and Halco on pricing and on the export levy on bauxite from the Sangaredi Mine of CBG led to the finalization of a draft agreement in mid-1987 to be effective at the beginning of 1988. The $13 per ton export levy was abolished in favor of a floating levy that would reflect world price movements, and the Government's 65% share of the profits from CBG was increased to an unspecified figure. After 1987, Government revenues from CBG could drop by as much as one-third from the guaranteed level of $150 million. Fortunately, the world aluminum market improved over the year, and progress continued toward expansion of production by the development of a mine opposite Sangaredi Mine across the Pora River at Bidi Koum.

The depressed aluminum market was disadvantageous to shareholders of the Fria bauxite mine, who were paying $175 per ton base price, subject to fuel, soda, and other costs, through 1987. The company had been losing income in the depressed market since 1984, and the Government was not getting the expected revenue from sales and the additional $12.75 per ton export tax. Deficits were about $5 million to $8 million per year through 1985 and 1986. The contract with the Government expired in 1987 and negotiations were progressing to change the purchase contract to make the mine's bauxite more competitive on the world market.

Bauxite from the third bauxite mine in Guinea, operated by Office des Bauxites de Kindia, continued to export primarily to the U.S.S.R. under a barter contract to service

the Government's debt to the Soviet Union. This contract with the Soviets was due to be renegotiated with the objective of obtaining better value of goods in exchange for the bauxite. The Government also wanted to increase its participation in the mining and marketing of bauxite.

Gold.—Société Auriferè de Guinée (SAG) planned to begin in October 1988 the mining of 95%-fine alluvial gold from the Koron deposit, and later the Didi deposit, within its 350-square-kilometer concession in the Siguiri District of northeastern Guinea. SAG was owned 51% by Chevaning Mining and Exploration Co. Ltd. (CMC) of the United Kingdom and 49% by the Government. CMC in turn was owned 50.1% by Union Minière S.A. of Belgium and 49.9% by Omnium de Participations Mobilieres S.A., a private Swiss company involved in investment and financial services. The ore reserve at Koron was increased from 4 to 5.65 million cubic meters of gravel at an average grade of 0.08 troy ounce per cubic meter. The reserve at Didi was decreased from 3.5 to 2.63 million cubic meters at an average grade of 0.04 troy ounce per cubic meter.

Gold had been mined by independent native Guineans for many years from a laterite-covered layer of unconsolidated alluvial gravel, but large-scale mechanized mining was earlier thought to be potentially too difficult and costly. Two of the ten known deposits that would be mined first are in a 2-meter-thick gravel zone covered by 8 meters of overburden. The gold extraction plant would have the capacity to process about 2,500 cubic meters per day of gold-bearing gravel. Gold production during a 9-year period would be between 36,000 and 105,000 ounces per year, depending on the area mined, and the average operating cost would be an estimated $4.65 per cubic meter of gravel.

The owner of the Aredor diamond mine, Société Mixte Aredor-Guinea S.A., completed 1 month ahead of schedule the installation of a gold recovery plant to treat discarded material less than 2 millimeters in size at the gravel treatment plant. The plant contained five Knelson concentrators to recover gold down to about 10-micrometer size. The capital cost for the plant was about $400,000, which would be recovered within 3 months of operation. Production was to be 10,000 ounces per year beginning in September, and production during the last quarter of 1987 was 77 ounces of gold. Recovery was low because of problems with equipment and was expected to be erratic because the mining path was designed to follow diamond mineralization.

Gold exploration was scheduled to continue at Banora in the concession area held by the Dinguiraye Gold Mining Co. (DGM), which is in the northwest corner of the Siguiri Basin. DGM was owned by Kenor S.A. of Norway, France's Bureau de Recherches Géologiques et Minières (BRGM), and Middle East investors. Alluvial drilling has outlined a deposit at Matagania containing about 58,000 troy ounces of gold. The pay gravel zone, which is 1.5 meters thick and underlies 7.5 meters of overburden, had an average grade of 0.096 ounce of gold per ton. BRGM's feasibility study recommended an open pit mine having a life of 5 years, based on a gold price of $434 per ounce. Vein-type mineralization was also found in the area.

Aurum Development Co. Ltd., United Kingdom, in a joint venture with the Government, was exploring the Boko gold prospects in Lower Guinea, east of Conakry.

Iron Ore.—Negotiations continued with the World Bank to fund the development of the Mifergui-Nimba iron ore deposit near the Liberia-Guinea border. Development would be by a joint-venture company that would include the Government, the Liberian iron ore production company, the Liberian-American-Swedish Minerals Co. (LAMCO), which was operating on the Liberian side of the border, and BRGM of France.

Several product tonnage scenarios have been developed that showed required facilities, capital, and operating costs for the production of from 2 to 8 million tons annually of Liberian ore and 3 to 10 million tons annually of Guinean ore for an annual total of 8 to 14.5 million tons. The project would utilize existing Liberian facilities at the Nimba Mine and at the port of Buchanan, with the railroad and new facilities to be built in Guinea. The required work force in Guinea would be about 670, which would include 62 expatriates. Construction, from the beginning of detailed engineering to startup, would take a maximum of 3 years. Capital expenditures for startup would range from $276 million to $441 million. Apparently, the preferred plan was to produce a total of 12 million tons of ore per year after an initial investment of $276 million, but an agreement was reached to limit annual production to less than 6 million tons at an initial cost of less than $100 million.

Unfortunately, financial institutions continued to doubt that the world market could absorb new iron ore production. The iron

and steel industry was producing at reduced levels as a result of declining product demand, and estimates of future iron ore requirements were very conservative. This situation, compounded by a shortage of capital and investment uncertainties in West Africa, dampened enthusiasm for financial participation in this new project. The future of the project depended on the support of the steel industry, primarily in Western Europe, in the form of long-term contracts. Both Nigeria and Romania agreed to buy considerable quantities of high-grade Nimba ore, but more contracts were needed for the World Bank to participate. Meanwhile, to complicate matters, the Liberian Government and LAMCO were negotiating at yearend 1987 over LAMCO's desire to declare bankruptcy and to close down its Liberian mining operation. LAMCO claimed that it could not continue to compete in world markets against Australian and Brazilian iron ore producers, and some European steel mills had closed.

MINERAL FUELS

During June 1987, the Government invited oil companies to bid for five large offshore blocks at promotional seminars held in Houston, TX, and London, United Kingdom. The sizes of the blocks were from 9,200 to 10,000 square kilometers and were in areas having water depths of less than 200 meters. Geophysical, drilling, and other data accumulated since 1977 by Superior Oil Co. and Buttes Resources International of the United States were made available.

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[1]Physical scientist, Division of International Minerals.
[2]Mining Magazine (London). Sept. 1987, p. 213.

The Mineral Industry of Hungary

By Walter G. Steblez[1]

The output of Hungary's mineral industry in 1987 showed modest gains compared with that of 1986. The production of most nonfuel minerals increased, while that of natural gas and petroleum declined slightly. The country possessed few raw material resources apart from bauxite, lignite, some manganese, natural gas, and petroleum. One-half of Hungary's demand for raw materials was met by imports, mainly in the form of petroleum and natural gas from the Soviet Union. The country's output of fuels and raw materials constituted only 1% of its gross national product (GNP), while net consumption was about 7% of GNP. In 1987, Hungary's centrally planned economy registered overall gains. National income rose by 2.5% compared with that of 1986; industrial production increased by 3.7%. Although no new major projects were started during the year, substantial investment was made in mineral exploration, and new geological maps were prepared indicating newfound mineral deposits. About 1% of the country's national income was allocated for the exploration of mineral resources.

Government Policies and Programs.—Continuing economic reforms were the mainstay of the Government's economic policy. The chief aspects of Hungary's economic reforms were industrial decentralization, encouragement of private initiative and the market orientation of the country's industrial production. Emphasis was placed on the introduction and assimilation of high technology in the electronic, computer, processing, and fabricating sectors through the year 2000. The short-term economic plan for 1988 called for a reduction in Government subsidies to state-owned enterprises. The restructuring of uneconomic mining and metallurgical enterprises was expected to result in the early retirement of several hundred employees. The economic plan for 1988 called for the output of coal, natural gas, and petroleum to be at about 1987 levels. It also called for a decrease in hydrocarbon-based electric power generation and an increase in the production of nuclear-generated electric power. The planned output of pig iron and crude and rolled steel would be less than in 1987, but the production of specialty steels and higher value metal products would be greater. The 1988 plan also set growth in the chemical sector to exceed the national industrial average. As in 1987, large-scale state investment in the mineral industry was not planned for 1988.

PRODUCTION

In 1987, metallic ore production in Hungary was limited to bauxite and manganese. Copper, iron, lead, and zinc mining was discontinued owing to difficult geological conditions and depletion of economic resources. However, because of its scale and potential wealth, the deep-lying Recsk copper deposit may be mined in the near-term under more favorable financial conditions. The country's industrial mineral sector continued to meet Hungary's domestic and export requirements. The chemical industry showed the most activity in 1987 by increasing its production by 7% compared with that of 1986.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Bauxite, gross weight ----- thousand tons	2,917	2,994	2,815	3,022	[3]3,101
Alumina, gross weight ----------do----	836	811	798	856	[3]858
Metal, primary ----------	74,039	74,202	73,859	73,877	[3]75,500
Copper, metal:[e]					
Smelter, secondary ----------	100	100	100	100	100
Refined including secondary ----------	12,500	12,800	12,800	12,800	12,500
Gallium, metal[e] ----------	2,100	2,400	2,800	[r]3,200	3,200
Gold, mine output, Au content[e] thousand troy ounces--	30	20	20	20	18
Iron and steel:					
Iron ore:					
Gross weight -------- thousand tons--	441	383	311	--	--
Iron content ----------do----	106	92	75	--	--
Metal:					
Pig iron:					
For steel industry ---------do----	1,966	2,029	2,007	1,987	[3]2,053
For foundry use ---------do----	81	68	88	67	[3]56
Total ----------do----	2,047	2,097	2,095	2,054	[3]2,109
Ferroalloys:[e]					
Ferrosilicon ----------	10,000	9,000	9,000	9,000	10,000
Silicon metal ----------	2,000	2,000	2,000	2,000	2,000
Other ----------	2,000	2,000	2,000	2,000	2,000
Total ----------	14,000	13,000	13,000	13,000	14,000
Steel, crude --------thousand tons --	3,616	3,750	3,647	3,715	[3]3,622
Semimanufactures, rolled only --do----	2,815	2,953	2,863	2,898	[3]2,825
Lead:[e]					
Mine output, Pb content ----------	700	700	700	--	[3] --
Metal, refined, secondary ----------	100	100	100	100	100
Manganese ore:					
Run of mine:					
Gross weight ----------	103,580	115,885	115,334	106,009	[3]125,634
Mn content ----------	20,000	22,000	22,000	20,000	[3]24,000
Concentrate:					
Gross weight ----------	59,000	67,000	65,700	63,000	74,000
Mn content ----------	17,700	20,100	19,700	18,900	22,000
Vanadium, metal[e] ----------	250	275	300	300	300
Zinc:[e]					
Mine output, Zn content ----------	2,400	2,300	2,200	--	[3] --
Metal, smelter, secondary ----------	600	600	600	600	600
INDUSTRIAL MINERALS					
Cement, hydraulic --------- thousand tons--	4,243	4,145	3,678	3,846	[3]4,153
Clays:					
Bentonite:					
Raw ----------	79,807	64,158	59,853	79,888	[3]98,331
Processed ----------	56,850	45,759	44,431	47,504	[3]52,828
Kaolin:					
Raw ----------	37,375	38,869	29,038	29,837	[3]33,289
Processed ----------	7,874	8,303	6,485	6,032	[3]5,179
Lime, calcined ---------- thousand tons--	822	823	[r]801	831	[3]836
Nitrogen: N content of ammonia ------do----	813	814	791	811	810
Perlite ----------	93,503	94,360	94,460	109,360	[3]112,410
Pyrites, gross weight[e] ----------	7,000	7,000	7,000	7,000	7,000
Refractory materials, n.e.s.:					
Chamotte products ------ thousand tons--	166	164	153	132	135
Chrome magnesite products -------do----	48	38	39	42	45
Sand and gravel:					
Gravel --------thousand cubic meters--	10,665	10,317	8,529	8,179	8,200
Sand:					
Common[e] ----------do----	400	400	400	400	400
Foundry ---------- thousand tons--	579	591	560	519	[3]631
Sodium compounds:					
Hydroxide (caustic soda) ----------	191,646	193,693	193,719	201,684	[3]197,376
Sulfate[e] ----------	11,000	10,000	10,000	10,000	9,000
Stone:					
Dimension, all types ------ thousand tons--	7,060	5,874	5,718	5,966	6,000
Dolomite ----------do----	1,167	1,205	1,158	1,146	1,150
Limestone ----------do----	8,081	7,695	7,418	7,469	7,500
Quartzite ----------do----	14	22	37	33	35

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Sulfur:					
From pyrite[e]	3,000	2,000	2,000	1,000	1,000
Byproduct, elemental, all sources[e]	9,200	9,000	9,000	10,000	10,000
Total[e]	12,200	11,000	11,000	11,000	11,000
Sulfuric acid	605,659	549,159	520,338	539,775	[3]573,323
Talc[e]	17,000	17,500	17,000	16,000	15,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[e]	5,000	5,000	5,000	5,000	5,000
Coal:					
Bituminous thousand tons	2,827	2,573	2,639	2,325	[3]2,360
Brown do	14,406	14,448	14,016	13,821	[3]13,261
Lignite do	7,980	8,026	7,387	6,983	[3]7,223
Total do	25,213	25,047	24,042	23,128	[3]22,844
Coke:					
Coke oven:					
Metallurgical do	564	546	492	547	[3]669
Other[e] do	170	160	160	150	150
Total do	734	706	652	697	819
Gashouse[e] do	170	160	160	160	160
Total coke do	904	866	812	857	979
Fuel briquets do	1,533	1,549	1,722	2,006	[3]2,134
Gas:					
Manufactured million cubic feet	15,362	14,232	11,830	8,122	9,000
Natural, marketed do	229,899	244,060	263,306	250,663	[3]247,980
Natural gas liquids:[e]					
Natural gasoline thousand 42-gallon barrels	3,800	3,900	3,800	3,700	3,700
Liquefied petroleum gas do	3,500	3,500	3,500	3,400	3,400
Peat, agricultural use[e] thousand tons	70	70	70	75	70
Petroleum:					
Crude:					
As reported do	2,004	2,007	2,012	2,005	[3]1,914
Converted thousand 42-gallon barrels	13,587	13,607	13,641	13,594	[3]12,977
Refinery products:[4]					
Gasoline including naphtha do	20,153	21,479	22,644	24,310	[3]25,321
Kerosene and other light distillates[e 5] do	7,000	7,000	7,000	7,000	7,000
Distillate fuel oil do	23,454	25,909	24,506	26,088	[3]26,147
Residual fuel oil do	16,836	16,960	16,970	15,664	[3]17,296
Lubricants[e] do	1,000	1,000	1,000	1,000	1,000
Liquefied petroleum gas[e] do	1,000	1,000	1,000	1,000	1,000
Asphalt and bitumen[e] do	3,800	3,800	3,800	3,600	3,700
Paraffin and petrolatum[e] do	250	250	250	250	250
Total do	73,493	77,398	77,170	78,912	81,714

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

[1]Table includes data available through June 6, 1988.

[2]In addition to the commodities listed, diatomite, gypsum, and a variety of other crude construction materials such as common clays are produced, but available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

[4]Excludes refinery fuel and losses.

[5]Data derived by subtracting reported motor gasoline and white spirit data from reported light refinery products total.

TRADE

In 1987, the value of Hungary's exports rose by 7%, and the value of imports by 5% compared with respective 1986 levels. About 63% of the country's expenditures on imports were for energy, raw materials, and heavy industrial durables. Compared with those of 1986, Hungary's imports of energy products rose by 2%, most of which came from the Soviet Union. Approximately 35% of Hungary's net income from exports was from sales of industrial products and fuels, with exports of metals and chemicals showing the most marked increases in 1987. The U.S.S.R. remained Hungary's major supplier of metals and fuels.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate[2]	382,335	461,473	--	Czechoslovakia 265,293; East Germany 140,640; Romania 34,871.
Oxides and hydroxides[2]	599,352	669,045	18	U.S.S.R. 511,115; Poland 76,354; East Germany 23,928.
Ash and residue containing aluminum	1,373	1,877	--	Belgium-Luxembourg 851; Italy 519; West Germany 507.
Metal including alloys:[2]				
Scrap	6,928	7,002	--	Austria 3,917; Italy 1,714; West Germany 1,033.
Unwrought	50,528	61,200	25	Poland 10,260; Bulgaria 4,455; unspecified 25,077.
Semimanufactures	52,826	60,329	5,325	East Germany 8,286; West Germany 5,521; Sweden 5,504.
Antimony: Metal including alloys, all forms	40	--		
Cadmium: Metal including alloys, all forms	--	29	--	All to Czechoslovakia.
Chromium: Oxides and hydroxides	131	28	--	Italy 25; New Zealand 3.
Cobalt: Metal including alloys, all forms	7	--		
Columbium and tantalum: Metal including alloys, all forms, tantalum	1	--		
Copper:				
Ore and concentrate	192	--		
Oxides and hydroxides	--	5	--	All to Italy.
Sulfate	565	1,313	--	France 595; West Germany 312; United Kingdom 254.
Ash and residue containing copper	168	233	--	Netherlands 132; Belgium-Luxembourg 101.
Metal including alloys:				
Scrap	4,769	1,093	--	West Germany 625; Belgium-Luxembourg 250; Netherlands 108.
Unwrought	5,246	1,584	--	Yugoslavia 1,000; Austria 391; Belgium-Luxembourg 132.
Semimanufactures	6,081	5,395	865	West Germany 2,050; Austria 1,878.
Gold:				
Waste and sweepings value, thousands	--	$29	--	All to West Germany.
Metal including alloys, unwrought and partly wrought ---do---	--	$22	--	West Germany $20; Switzerland $2.
Iron and steel: Metal:				
Scrap	40,323	16,346	--	West Germany 4,191; Italy 3,873; Austria 3,791.
Pig iron, cast iron, related materials	1	57	--	West Germany 37; Belgium-Luxembourg 20.
Ferroalloys:				
Ferrosilicon	--	21	--	All to Italy.
Unspecified	--	10	--	All to Sweden.
Steel, primary forms[2]	37,719	62,824	5,566	Austria 15,374; West Germany 9,947; Egypt 7,001.
Semimanufactures:				
Bars, rods, angles, shapes, sections[2]	721,646	696,235	--	U.S.S.R. 196,000; Bulgaria 67,848; Italy 35,701.
Universals, plates, sheets[2]	320,329	327,720	20,930	Japan 47,231; Italy 46,328.
Hoop and strip[2]	17,184	20,127	15	Yugoslavia 6,492; Syria 3,549; Czechoslovakia 1,561.
Rails and accessories	27	84	--	All to West Germany.
Wire[2]	19,516	20,995	20	Lebanon 4,906; Yugoslavia 4,121; U.S.S.R. 4,056.
Tubes, pipes, fittings[2]	81,102	72,620	159	China 15,247; U.S.S.R. 12,339; Austria 11,276.
Castings and forgings, rough[2]	15,385	12,919	283	Poland 3,450; West Germany 2,259; Sweden 1,853.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Lead:				
Ash and residue containing lead	1,121	838	--	All to West Germany.
Metal including alloys:				
Scrap	2,168	951	--	West Germany 934; Netherlands 17.
Unwrought	--	19	--	All to United Kingdom.
Semimanufactures	4	--		
Lithium: Metal including alloys, all forms	4	2	--	All to West Germany.
Manganese: Ore and concentrate, metallurgical-grade	[2]11,417	[3]9,100	NA	NA.
Molybdenum: Metal including alloys, all forms	3	5	--	Yugoslavia 4; West Germany 1.
Nickel:				
Matte and speiss	35	--		
Ash and residue containing nickel	--	25	--	West Germany 14; Netherlands 11.
Metal including alloys:				
Scrap	377	110	--	West Germany 78; Netherlands 32.
Unwrought	22	223	--	Austria 208; Sweden 8; Netherlands 6.
Semimanufactures	161	239	2	West Germany 135; Yugoslavia 42; France 40.
Platinum-group metals:				
Waste and sweepings value, thousands	$3,432	$4,078	--	All to West Germany.
Metals including alloys, unwrought and partly wrought ---do---	$38	$3	--	All to Switzerland.
Silver:				
Waste and sweepings ---do---	$208	[4]$19	--	Switzerland $16; United Kingdom $3.
Metal including alloys, unwrought and partly wrought ---do---	$518	$889	--	West Germany $670; Austria $176; United Kingdom $29.
Tin:				
Ash and residue containing tin	20	39	--	All to West Germany.
Metal including alloys:				
Scrap	16	33	--	All to Switzerland.
Unwrought	20	--		
Semimanufactures	1	--		
Titanium: Metal including alloys, all forms	--	1	--	All to Ireland.
Tungsten:				
Ore and concentrate	44	27	--	West Germany 22; Netherlands 5.
Metal including alloys, all forms	22	39	--	West Germany 34; United Kingdom 3; Yugoslavia 2.
Zinc:				
Matte	416	414	--	West Germany 267; Italy 174.
Ash and residue containing zinc	4,166	1,657	--	West Germany 1,611; Belgium-Luxembourg 46.
Metal including alloys:				
Scrap	636	401	--	West Germany 276; Belgium-Luxembourg 54; Italy 49.
Unwrought	20	--		
Semimanufactures	--	1	--	All to West Germany.
Other:				
Ores and concentrates	--	49	--	All to Austria.
Ashes and residues	30,051	3,183	--	Italy 2,705; West Germany 300; Sweden 158.
Base metals including alloys, all forms	34	21	--	Sweden 17; Austria 1; France 1.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	500	244	217	Norway 20; West Germany 7.
Artificial:				
Corundum[2]	18,750	20,472	298	Romania 4,612; Japan 3,325; Austria 2,466.
Silicon carbide	--	2	--	All to West Germany.
Dust and powder of precious and semiprecious stones including diamond value, thousands	--	$45	$15	Greece $22; Italy $4.
Grinding and polishing wheels and stones[2] ---do---	$1,368	$1,271	$119	East Germany $327; Poland $316; Romania $189.
Asbestos, crude	--	1,943	--	All to Belgium-Luxembourg.
Bromine	--	4	--	All to Italy.
Cement[2]	49,319	55,770	--	U.S.S.R. 27,583; Yugoslavia 23,710; West Germany 3,354.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS — Continued				
Clays, crude:				
Bentonite[2]	10,338	11,423	--	East Germany 6,232; Poland 5,191.
Kaolin[2]	8,098	7,443	--	Czechoslovakia 6,172; West Germany 1,271.
Unspecified	704	1,390	--	Austria 975; West Germany 179; Yugoslavia 168.
Cryolite and chiolite	--	238	138	Norway 100.
Diamond:				
Gem, not set or strung value, thousands	$23	$50	--	Italy $37; Austria $13.
Industrial stones do.	$239	$629	--	Belgium-Luxembourg $509; Austria $120.
Diatomite and other infusorial earth	2,829	3,066	--	Austria 2,938; Greece 108; France 20.
Feldspar, fluorspar, related materials	977	766	--	All to Austria.
Fertilizer materials:				
Crude, n.e.s	441	120	--	Switzerland 92; Italy 22; West Germany 6.
Manufactured:				
Ammonia[2] thousand tons	44	60	--	Yugoslavia 49; Austria 4; Italy 3.
Nitrogenous do.	[2]1,592	[2]1,418	--	Yugoslavia 100; West Germany 75; unspecified 1,165.
Unspecified and mixed do.	187	144	--	West Germany 78; Austria 39; Finland 10.
Kyanite and related materials	103	360	--	West Germany 287; United Kingdom 73.
Magnesium compounds	90	36	--	Austria 24; Italy 12.
Mica:				
Crude including splittings and waste	8	138	138	
Worked including agglomerated splittings	--	1	--	All to France.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$4	$83	--	Austria $58; France $15; Spain $9.
Synthetic do.	$45	$23	--	All to United Kingdom.
Pyrite, unroasted	--	53	--	All to Austria.
Salt and brine	21	42	--	All to United Kingdom.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	--	1	--	Do.
Sulfate, manufactured	170	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked[2]	14,181	12,101	--	U.S.S.R. 7,061; East Germany 2,756; Czechoslovakia 1,458.
Worked	37	42	--	Austria 37; West Germany 5.
Dolomite, chiefly refractory-grade	67	81	--	Finland 80; West Germany 1.
Gravel and crushed rock	11,963	2,037	--	Yugoslavia 1,424; Austria 345; West Germany 268.
Quartz and quartzite	16,815	10,774	--	All to Austria.
Sand other than metal-bearing[2]	32,136	40,215	--	Yugoslavia 28,622; Austria 7,599; Czechoslovakia 3,935.
Sulfur:				
Elemental:				
Crude including native and byproduct	16,768	18,031	--	Austria 18,020; Ireland 11.
Colloidal, precipitated, sublimed	--	59	--	All to Yugoslavia.
Sulfuric acid[2]	62,365	38,948	--	Bulgaria 19,092; Yugoslavia 9,424; Austria 7,536.
Talc, steatite, soapstone, pyrophyllite	15	1	--	All to West Germany.
Vermiculite, perlite, chlorite	7,706	11,921	--	Do.
Other:				
Crude[2]	76,039	83,481	--	Austria 24,462; Poland 14,814; Yugoslavia 10,898.
Slag and dross, not metal-bearing	1,271	727	--	All to Austria.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	6,747	276	--	Do.
Carbon black	678	1,550	--	West Germany 1,216; Italy 288; Yugoslavia 34.
Coal:				
Anthracite and bituminous thousand tons	[3]483	18	--	All to Yugoslavia.
Lignite including briquets do.	[2]294	1	--	Mainly to France.
Gas, natural: Gaseous million cubic feet	735	695	--	All to U.S.S.R.
Peat including briquets and litter[2]	6,299	4,470	--	Austria 2,185; Italy 1,212; Yugoslavia 1,050.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude thousand 42-gallon barrels	--	6	--	All to Yugoslavia.
Refinery products:				
Liquefied petroleum gas[2] do	461	418	--	Italy 310; Austria 44; Netherlands 39.
Gasoline do	1,512	2,208	--	West Germany 912; Austria 592; Switzerland 431.
Mineral jelly and wax[2] do	315	348	8	West Germany 72; Italy 60; Morocco 43.
Kerosene and jet fuel do	876	1,039	--	Austria 503; West Germany 353; Yugoslavia 142.
Distillate fuel oil do	3,253	5,400	--	Austria 1,858; Switzerland 1,724; West Germany 1,525.
Lubricants[2] do	485	417	--	Austria 214; Yugoslavia 75; U.S.S.R. 56.
Residual fuel oil do	14	9	--	All to Italy.
Bitumen and other residues[2] do	458	575	--	Austria 282; West Germany 242; Bulgaria 21.
Bituminous mixtures do	23	18	--	West Germany 17.

[p]Preliminary. NA Not available.

[1]Table prepared by Jozef Plachy. Owing to a lack of official trade data published by Hungary, this table should not be taken as a complete presentation of this country's mineral trade. Unless otherwise specified, these data were compiled from United Nations information and data published by the trading partner countries.

[2]Official Trade Statistics of Hungary.

[3]Statistical Yearbook of Member States of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

[4]May include other precious metals.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	--	3	--	All from Italy.
Aluminum:				
Ore and concentrate	1,125	1,588	--	West Germany 1,533; Austria 54; Switzerland 1.
Oxides and hydroxides	130	84	8	Netherlands 29; Italy 20; West Germany 11.
Metal including alloys:				
Scrap	--	24	--	All from United Kingdom.
Unwrought[2]	165,294	205,007	--	U.S.S.R. 198,773; Romania 6,233.
Semimanufactures[2]	3,176	3,639	3	East Germany 2,146; Czechoslovakia 433; Austria 307.
Antimony: Oxides	48	10	--	All from France.
Bismuth: Metal including alloys, all forms	--	1	--	All from West Germany.
Chromium:				
Ore and concentrate	15,256	15,376	--	U.S.S.R. 15,000; Finland 230; West Germany 146.
Oxides and hydroxides	388	176	--	United Kingdom 175; France 1.
Cobalt:				
Oxides and hydroxides	--	30	--	All from Finland.
Metal including alloys, all forms	21	1	--	All from West Germany.
Columbium and tantalum: Metal including alloys, all forms:				
Columbium (niobium)	(3)	1	--	Do.
Tantalum	--	(3)	(3)	

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Copper:				
Oxides and hydroxides	--	5	--	All from West Germany.
Sulfate[2]	3,550	3,520	--	U.S.S.R. 3,500; Greece 20.
Metal including alloys:				
Scrap	6,534	8,473	--	Chile 4,947; West Germany 1,607; Belgium-Luxembourg 1,163.
Unwrought[2]	28,129	36,600	--	U.S.S.R. 15,412; Poland 6,343; Chile 5,495.
Semimanufactures	[2]11,477	[2]15,706	7	West Germany 1,350; Austria 307; unspecified 13,306.
Gold: Metal including alloys, unwrought and partly wrought value, thousands	$561	$620	$3	West Germany $553; Switzerland $48; United Kingdom $16.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite[2] thousand tons	2,382	3,414	--	U.S.S.R. 3,140; Brazil 87; India 54.
Pyrite, roasted do	44	17	--	All from Yugoslavia.
Metal:				
Scrap	14,000	8,000	--	Yugoslavia 3,000; unspecified 4,000.
Pig iron, cast iron, related materials[2]	272,413	254,297	2	U.S.S.R. 251,923; Austria 2,315; West Germany 36.
Ferroalloys:				
Ferrochromium[2]	10,390	11,183	--	U.S.S.R. 7,440; Yugoslavia 1,200; Sweden 754.
Ferromanganese[2]	44,951	42,250	--	U.S.S.R. 23,384; Czechoslovakia 3,680.
Ferrosilicomanganese	--	30	--	All from West Germany.
Ferrosilicon[2]	6,742	7,424	--	U.S.S.R. 7,362; France 62.
Silicon metal	1,005	1,173	--	Yugoslavia 548; Italy 525; West Germany 100.
Unspecified[2]	15,060	14,982	--	U.S.S.R. 11,776; Austria 827; Belgium-Luxembourg 596.
Steel, primary forms[2]	479,115	482,874	--	U.S.S.R. 419,081; Bulgaria 33,319; Turkey 15,000.
Semimanufactures:				
Bars, rods, angles, shapes, sections[2]	187,499	190,775	1	U.S.S.R. 150,319; Czechoslovakia 17,296; Poland 12,177.
Universals, plates, sheets[2]	340,130	335,716	--	U.S.S.R. 235,270; Spain 17,405; Italy 15,964.
Hoop and strip[2]	8,395	7,878	--	West Germany 2,993; France 1,199; Czechoslovakia 997.
Rails and accessories	308	88	--	West Germany 87; Austria 1.
Wire[2]	34,776	30,541	(3)	Czechoslovakia 10,394; U.S.S.R. 6,067; West Germany 4,463.
Tubes, pipes, fittings[2]	77,160	59,055	33	East Germany 15,322; Czechoslovakia 13,356; Romania 9,776.
Castings and forgings, rough[2]	14,053	12,059	1	Poland 8,468; Italy 993; East Germany 773.
Lead:				
Ore and concentrate	1,800	--		
Oxides	632	285	--	West Germany 150; France 70; Italy 46.
Ash and residue containing lead	25	--		
Metal including alloys:				
Unwrought[2]	7,454	6,729	--	U.S.S.R. 4,993; Bulgaria 500; West Germany 239.
Semimanufactures	13	10	--	West Germany 9; United Kingdom 1.
Magnesium: Metal including alloys:				
Scrap	5	2	--	All from West Germany.
Unwrought	579	265	--	Italy 145; France 120.
Semimanufactures	25	11	--	West Germany 7; Italy 3; France 1.
Manganese:				
Ore and concentrate, metallurgical-grade[2]	480	440	--	All from Belgium-Luxembourg.
Oxides	--	204	--	All from Japan.
Mercury 76-pound flasks	580	--		
Molybdenum:				
Ore and concentrate	34	80	--	All from Belgium-Luxembourg.
Metal including alloys, all forms	17	2	--	France 1; West Germany 1.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Nickel:				
Matte and speiss, Ni content	202	--		
Metal including alloys:				
Scrap	--	3	--	All from United Kingdom.
Unwrought	3	20	--	United Kingdom 18; Japan 2.
Semimanufactures	114	81	--	West Germany 30; United Kingdom 27; Sweden 12.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$4,171	$5,904	$33	West Germany $4,884; Switzerland $892; Netherlands $72.
Silver:				
Waste and sweepings ---do---	--	$50	$50	
Metal including alloys, unwrought and partly wrought ---do---	$4,574	$1,674	--	West Germany $1,518; Austria $80; Netherlands $11.
Tin:				
Oxides	2	--		
Metal including alloys:				
Unwrought[2]	1,277	1,422	--	West Germany 167; Vietnam 20; unspecified 1,201.
Semimanufactures	20	26	(3)	Netherlands 15; West Germany 7; United Kingdom 4.
Titanium:				
Ore and concentrate	3,308	3,230	--	West Germany 2,630; Netherlands 600.
Oxides	1,401	2,032	--	United Kingdom 1,248; France 467; Belgium-Luxembourg 180.
Metal including alloys, all forms	--	1	--	All from West Germany.
Tungsten:				
Ore and concentrate	58	15	--	All from Portugal.
Oxides and hydroxides	--	15	--	All from France.
Metal including alloys, all forms	3	5	(3)	West Germany 3; France 2.
Zinc:				
Oxides	2,195	1,054	--	France 714; Italy 282; United Kingdom 42.
Ash and residue containing zinc	--	1	--	All from Netherlands.
Metal including alloys:				
Unwrought[2]	20,543	28,167	--	Poland 8,253; U.S.S.R. 5,077; Bulgaria 4,371.
Semimanufactures	[2]5,857	[2]5,634	--	Belgium-Luxembourg 667; Yugoslavia 521; unspecified 4,130.
Zirconium: Ore and concentrate	4,498	5,181	--	Italy 4,778; West Germany 375; Netherlands 28.
Other:				
Ores and concentrates[2]	9,506	7,881	--	Cuba 7,014; West Germany 841; Austria 26.
Oxides and hydroxides	11	19	--	Netherlands 10; United Kingdom 9.
Ashes and residues	184	10	--	All from West Germany.
Base metals including alloys, all forms	62	76	3	Austria 61; Finland 8.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	63	70	--	Italy 37; Greece 22; Netherlands 6.
Artificial:				
Corundum[2]	1,434	1,289	--	West Germany 466; Italy 460; Norway 151.
Silicon carbide	932	397	--	All from Italy.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$156	$128	$22	Belgium-Luxembourg $99; Netherlands $5.
Grinding and polishing wheels and stones[2] ---do---	$4,812	$5,208	$15	U.S.S.R. $1,575; East Germany $31; Poland $12.
Asbestos, crude[2]	33,596	31,059	--	U.S.S.R. 28,543; Botswana 1,231; Italy 676.
Barite and witherite	16,172	14,590	--	Yugoslavia 11,200; West Germany 3,218; Ireland 102.
Boron materials:				
Crude natural borates	--	47	--	All from France.
Oxides and acids	10,962	1,940	--	All from U.S.S.R.
Bromine[2]	649	655	--	Israel 375; East Germany 179; U.S.S.R. 101.
Cement[2]	719,956	714,770	--	U.S.S.R. 466,081; Romania 135,231; East Germany 95,724.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Chalk	1,719	1,967	--	Austria 1,586; France 334; Italy 24.
Clays, crude:[2]				
Chamotte earth	65,269	64,821	--	Czechoslovakia 59,817; Israel 2,194; Poland 2,036.
Kaolin	59,451	63,278	--	Austria 3,331; East Germany 11,116; Czechoslovakia 9,741.
Unspecified	74,558	66,233	20	Czechoslovakia 44,568; Poland 13,546; East Germany 4,424.
Diamond:				
Gem, not set or strung value, thousands	$129	$252	$6	Switzerland $127; Austria $78; Belgium-Luxembourg $41.
Industrial stones do.	$1,430	$2,014	$1	Belgium-Luxembourg $1,804; Austria $65; United Kingdom $60.
Diatomite and other infusorial earth	2,182	1,155	--	Iceland 588; Austria 464; France 102.
Feldspar, fluorspar, related materials:				
Feldspar	--	1,258	--	Yugoslavia 925; France 213; Spain 120.
Fluorspar	1,196	689	--	West Germany 599; United Kingdom 66; France 24.
Unspecified	1,176	1,557	--	Norway 1,234; Sweden 220; France 103.
Fertilizer materials:				
Crude, n.e.s	221	263	--	France 221; Italy 22; West Germany 20.
Manufactured:				
Ammonia	3,032	1,016	--	All from Yugoslavia.
Nitrogenous, N_2 content[2]	309,810	312,909	--	All from U.S.S.R.
Phosphatic, P_2O_5 content[2]	96,696	63,532	--	U.S.S.R. 26,164; Yugoslavia 16,608; Austria 14,213.
Potassic, K_2O content[2]	514,576	445,862	--	U.S.S.R. 315,127; East Germany 128,095; West Germany 2,640.
Unspecified and mixed[2]	124,092	151,465	6,615	Yugoslavia 74,069; Morocco 32,223; U.S.S.R. 17,047.
Graphite, natural	368	630	--	Austria 330; West Germany 260; United Kingdom 28.
Gypsum and plaster[2]	82,133	77,830	1	East Germany 65,206; Romania 12,283; West Germany 305.
Iodine[2]	45	27	--	U.S.S.R. 25; West Germany 2.
Lime[2]	39,041	61,224	--	Czechoslovakia 47,131; Yugoslavia 13,922; West Germany 91.
Magnesium compounds[2]	94,990	100,032	--	Czechoslovakia 79,028; Albania 7,802; Austria 5,230.
Mica:				
Crude including splittings and waste	190	181	--	France 108; United Kingdom 47; Austria 26.
Worked including agglomerated splittings	47	49	--	West Germany 24; Switzerland 18; Austria 6.
Phosphates, crude[2]	575,883	585,147	--	U.S.S.R. 453,432; Morocco 70,443; Algeria 61,272.
Pigments, mineral:				
Natural, crude	--	2	--	All from West Germany.
Iron oxides and hydroxides, processed	3,500	529	--	Italy 424; Belgium-Luxembourg 105.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$91	$140	$11	Switzerland $124; West Germany $5.
Synthetic do.	$176	$186	--	Switzerland $152; West Germany $20; Japan $13.
Pyrite, unroasted[2]	37,568	73,563	--	U.S.S.R. 44,344; Albania 14,500; Czechoslovakia 13,871.
Salt and brine[2]	672,310	735,959	--	Romania 464,345; U.S.S.R. 163,900; Poland 69,771.
Sodium compounds, n.e.s.: Carbonate, manufactured[2]	186,423	192,070	--	Bulgaria 101,723; Romania 49,137; East Germany 14,526.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked[2]	17,748	15,870	--	Bulgaria 8,670; Cuba 3,181; Italy 1,445.
Worked	1,628	1,140	--	Italy 711; Yugoslavia 332; Austria 53.
Dolomite, chiefly refractory-grade	17	26	--	Austria 14; West Germany 12.
Gravel and crushed rock	10,600	10,754	--	Austria 7,119; Italy 3,156; West Germany 269.
Limestone other than dimension	73	229	229	
Quartz and quartzite	2,536	2,247	--	West Germany 1,878; Finland 155; Netherlands 126.
Sand other than metal-bearing[2]	120,168	116,808	7	Czechoslovakia 84,811; East Germany 23,671; Australia 5,482.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur:				
Elemental:				
Crude including native and byproduct[2]	171,503	167,395	--	Poland 138,702; U.S.S.R. 28,672; West Germany 21.
Dioxide	275	137	--	All from West Germany.
Sulfuric acid	305	182	--	Italy 91; West Germany 51; Netherlands 40.
Talc, steatite, soapstone, pyrophyllite	2,465	2,256	--	Austria 1,261; Finland 702; Italy 293.
Other:				
Crude	1,153	1,108	--	West Germany 952; Austria 156.
Slag and dross, not metal-bearing	--	43	--	All from Austria.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	46	30	--	All from West Germany.
Carbon:[2]				
Carbon black	243	748	--	East Germany 350; U.S.S.R. 337; Czechoslovakia 25.
Gas carbon	23,754	30,057	--	U.S.S.R. 29,890; West Germany 166.
Coal:				
Anthracite and bituminous[2] thousand tons	2,518	2,317	10	U.S.S.R. 1,240; Poland 535; Czechoslovakia 250.
Briquets of anthracite and bituminous coal[2] do	676	818	--	East Germany 735; Poland 59; West Germany 20.
Lignite including briquets do	208	296	--	Yugoslavia 276; West Germany 20.
Coke and semicoke[2] do	949	1,124	--	Yugoslavia 569; Czechoslovakia 169; U.S.S.R. 166.
Gas, natural: Gaseous[2] million cubic feet	141,568	168,023	--	U.S.S.R. 165,763; Romania 2,260.
Peat including briquets and litter	5	49	--	Sweden 28; West Germany 21.
Petroleum:				
Crude[2] thousand 42-gallon barrels	53,370	55,575	--	U.S.S.R. 53,678; Iran 1,897.
Refinery products:				
Liquefied petroleum gas[2] do	259	255	--	U.S.S.R. 237; Austria 18.
Gasoline[2] do	3,265	3,165	--	U.S.S.R. 2,969; Yugoslavia 170; Albania 25.
Mineral jelly and wax[2] do	10	14	[3]	U.S.S.R. 12; Poland 1.
Kerosene and jet fuel[2] do	1,214	1,229	--	U.S.S.R. 922; East Germany 101; Algeria 31.
Distillate fuel oil[2] do	5,696	5,639	--	U.S.S.R. 5,543; United Kingdom 96.
Lubricants[2] do	120	186	[3]	U.S.S.R. 146; Austria 10; Netherlands 9.
Residual fuel oil[2] do	3,679	2,829	--	Austria 1,394; U.S.S.R. 1,298; United Kingdom 137.
Bitumen and other residues do	2	[3]	--	Mainly from Austria.
Bituminous mixtures do	1	4	--	West Germany 3; Sweden 1.
Petroleum coke do	8	18	--	Norway 16; West Germany 2.

[p]Preliminary.

[1]Table prepared by Jozef Plachy. Owing to a lack of official trade data published by Hungary, this table should not be taken as a complete presentation of this country's mineral trade. Unless otherwise specified, these data were compiled from United Nations information and data published by the trading partner countries.

[2]Official Trade Statistics of Hungary.

[3]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—Hungary was the eighth largest bauxite producer in the world, with an economic reserve base of approximately 170 million tons, which would be sufficient for about 40 years at the 1987 mining rate. The Al_2O_3 content of Hungarian bauxite ranged from 42% to 56%; SiO_2 from 1% to 11%. All of the country's bauxite, alumina, and aluminum operations were managed by the Hungarian

Aluminum Trust (Hungalu). In 1986 and 1987, Hungalu's subsidiary, the Bauxite Exploration Enterprise, explored bauxite deposits in the western part of the country at Nagytarkany and Nyirad. Prospective economic deposits of higher than average quality bauxite were found in five locations and were expected to add about 1 million tons of bauxite to the country's reserves. Exploration in this region was to have been completed by mid-1987. Earlier investigations indicated other deposits in the Transdanubian mountain range. In 1986, other bauxite deposits were reportedly situated on the periphery of the Nagyegyhaza coalfields. In 1987, Hungalu's exports were valued at $190 million, and planned exports for 1988 were expected to reach $240 million. A substantial share of exported aluminum was sold to the Federal Republic of Germany, Japan, and the United States.

Hungalu's total labor force was about 20,000, of which 5,000 were involved with bauxite mining. The company processed nearly 85% of its annual bauxite production into alumina, and in accordance with the Soviet-Hungarian alumina agreement for 1986-90, annually sent 530,000 tons of alumina to the Soviet Union for smelting into aluminum. In return, Hungary received 205,000 tons of aluminum ingot. Also, as partial payment, Hungary supplied the U.S.S.R. with 5,000 tons of aluminum semimanufactures per year. This arrangement with the Soviet Union was necessitated by Hungary's relative shortage and the Soviet Union's abundance of electric power. To remain competitive, Hungalu maintained a policy of streamlining its production structure. Recent investments included the completion in 1987 of a new alumina refractory unit for industrial boilers at the Masonmagyarovar alumina plant.

Copper.—Although Hungary stopped mining copper in the late 1970's, the country's copper deposit at Recsk was estimated to be among the 20 largest deposits in the world. The Recsk ore body lay 400 meters to 1,200 meters below the surface. The sulfide ore was also found to contain valuable components of gold, lead, molybdenum, silver, and zinc. Mine development had been constrained by limited financial resources and low copper prices. In 1987, Hungary reportedly conducted negotiations with the Soviet Union concerning possible Soviet participation in processing some of the Recsk ore when the mine becomes operational in the late 1990's.

Gallium.—Hungary remained a substantial world producer of gallium as a byproduct of alumina processing at the Ajka alumina plant. A new 3-ton-per-year unit was reportedly under construction at Ajka in 1987 and was scheduled for completion by mid-1988. The new unit would double Hungary's annual production of gallium to 6 tons. Most of the country's gallium output was exported to high-technology electronics industries.

Manganese.—The National Ore and Mineral Mines Enterprise mined both oxidized and carbonated manganese ore at the Urkut Mine in Bakony. Most of the ore produced in 1987 was oxidic and contained between 30% and 40% manganese. Most of the manganese concentrate was exported, although a small amount of ferromanganese was produced domestically.

Steel.—Hungary had to rely entirely on imports to meet its domestic requirements for iron ore. Although most of the country's needs were met by imports from the Soviet Union, Hungary began to look in 1986 for the availability of higher grade ore in Australia, Brazil, Canada, India, and Sweden. At yearend 1987, the Hungarian Government and Hancock Mining Ltd. of Western Australia signed a memorandum of understanding to supply Hungary with 500,000 tons of ore per year for up to 15 years. The agreement would be reviewed every 2 years to determine additional need, and it provided for possible added annual shipments of up to 1.5 million tons of ore.

Hungary continued to modernize its steel industry in 1987. Plans were drawn to replace open-hearth systems with oxygen converters. Other plans were to increase continuous casting capacity, alloy steel production and sales, and to improve the quality of rolled products. During the year, the Danube Iron and Steel Works at Dunaujvaros began to modernize its hot-rolling mill and planned to upgrade the cold-rolling unit in 1988. In 1987, the Danube Works increased production of higher value products and planned the construction of a new foundry. The Ozd Iron and Steel Works reportedly reduced operational losses during the year, closed down an open-hearth furnace together with a number of other units, and plan-

ned to concentrate production mainly on rolled steel products. As part of Ozd's structural reorganization, management was to be reduced by 200 employees in 1987 and 1988. The Lenin Iron and Steel Works at Diosgyor reduced its labor force by 1,000 employees in 1987, and planned even greater work force reductions in 1988.

INDUSTRIAL MINERALS

Hungary produced a wide variety of industrial minerals. Bentonite, gypsum, kaolin, perlite, and zeolite were produced in sufficient amounts to meet domestic and some export needs. Hungary's industrial mineral production was managed by the National Ore and Mineral Mines Enterprise. In aggregate, annual output of industrial minerals has been about 4 million tons.

MINERAL FUELS

Coal.—In 1987, the Tatabanya Coal Mining Enterprise suspended operations at the Many coal mine. Underground water was reportedly 10 times greater than originally calculated. The company planned to sell off the mine's machinery and equipment. A new opencast lignite mine was put on-stream at Vadna in Borsod County. The mine was expected to produce through mid-1988 at a rate of 1,000 tons per day. The development of a new coalfield was reported at Visonta in the northern part of the country. Reserves were determined at about 90 million tons, and operational startup was scheduled for early 1990. Earth moving and drainage work was begun in 1987 to prepare the site for mine development.

Natural Gas and Petroleum.—Planned production targets for natural gas and petroleum were exceeded in 1987. Most of Hungary's need for petroleum and natural gas were met by imports from the U.S.S.R.

Nuclear Power.—At yearend, a fourth Soviet 440-megawatt reactor block was put into operation at the Paks nuclear powerplant. With the new capacity, the plant would generate almost one-half of Hungary's electricity. Hungary continued to mine uranium at Mecsek. The ore was processed in the Soviet Union and used to fuel the Paks reactors.

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[1]Foreign mineral specialist, Division of International Minerals.

The Mineral Industry of Iceland

By Richard H. Singleton[1]

Little change occurred in Iceland's metals and minerals industry in 1987 except for an increase in cement and primary aluminum production. The aluminum and ferrosilicon industries, both energy-intensive, comprised approximately 90% of the value of total minerals production. Essentially all of the products of these energy-intensive industries were exported. The Government continued to promote development of these industries, and discussions were held with world metals producers regarding the possibility of a silicon smelter in eastern Iceland and a larger aluminum smelter adjacent to the existing aluminum smelter.

Strong economic growth continued for the second consecutive year as the gross domestic product (GDP) increased once again by about 6% in real value. This was again caused by the higher fish catch and the higher prices for fish as this product continued to account for 20% to 25% of the GDP and over one-half of total export value. However, many economic indices turned negative by yearend. Inflation almost doubled during 1987, reaching 25%. Imports increased more rapidly than exports because of increased buying power caused by large wage increases. This caused the current account to return to a deficit after only 1 year of surplus.

The minerals industry, including metals production, accounted for about 4% of the GDP and 13% of total export value in 1987. It accounted for less than 1% of the labor force but utilized about 60% of Iceland's electrical power.

PRODUCTION AND TRADE

Sales of cement, all domestic, increased significantly, reflecting increased activity in construction of buildings. Decreased production of ferrosilicon was caused by a number of plant operating difficulties that caused 5 weeks of unscheduled downtime. Iceland's trade balance showed a deficit of about $210 million,[2] nearly 10 times that of 1986. The United States imported nearly 20,000 tons of ferrosilicon during 1986. Exports of pumice decreased significantly in 1986.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
Aluminum metal, primary[2]	76,077	80,359	73,403	75,929	83,485
Cement, hydraulic[3] thousand tons	115	118	114	111	131
Diatomite	25,501	27,265	29,388	22,897	[e]23,000
Iron and Steel: Ferrosilicon	50,313	60,976	60,328	66,787	60,184
Nitrogen: N content of ammonia	[e]7,000	[e]7,000	7,532	7,980	7,437
Pumice and related volcanic material:					
Pumice	45,000	55,000	56,000	52,500	58,792
Scoria[e] cubic meters	10,000	10,000	6,000	2,000	[4]271
Salt	500	950	1,350	704	1,830
Sand:					
Basaltic cubic meters	5,500	4,000	5,500	[e]5,000	5,400
Calcareous, shell thousand cubic meters	125	115	100	129	115
Sand and gravel do	[e]5,000	4,700	4,150	4,088	4,816
Silica dust[5]	[3]8,326	[3]7,221	[3]7,873	13,886	12,131
Stone, crushed:					
Basaltic thousand tons	[e]100	90	80	77	114
Rhyolite	20,400	20,000	25,755	23,114	22,700

[e]Estimated. [p]Preliminary.
[1]Table includes data available through May 20, 1988.
[2]Ingot and rolling billet production.
[3]Sales.
[4]Reported figure.
[5]Byproduct of ferrosilicon.

Table 2.—Iceland: Exports of selected mineral commodities[1]

(Metric tons)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
Abrasives, n.e.s.: Natural: Corundum, emery, pumice, etc	50,013	36,939	239	West Germany 11,685; Norway 11,282; Denmark 9,271.
Aluminum: Metal including alloys, unwrought	70,600	77,490	--	Switzerland 22,971; West Germany 17,365; United Kingdom 15,114.
Diatomite and other infusorial earth	27,123	23,423	--	West Germany 6,543; Austria 2,922; Italy 2,147.
Iron and steel: Metal:				
Scrap	6,237	2,527	--	Netherlands 2,283; West Germany 244.
Ferroalloys, ferrosilicon	56,845	64,990	19,587	Japan 22,848; West Germany 16,429.
Stone, sand and gravel: Dimension stone, crude and partly worked	7,955	591	410	Denmark 128; West Germany 22.
Other: Base metals including alloys, scrap	898	635	--	Netherlands 496; West Germany 51; Denmark 39.

[1]Table prepared by Jozef Plachy.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	197,130	138,028	--	Australia 138,015; United Kingdom 7; West Germany 6.
Metal including alloys:				
Scrap	10	1	--	All from Denmark.
Unwrought	112	87	--	United Kingdom 61; Netherlands 25; Sweden 1.
Semimanufactures	932	1,197	25	West Germany 239; Norway 204; Sweden 133.
Beryllium: Metal including alloys, all forms	--	(2)	--	All from Netherlands.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Chromium: Oxides and hydroxides	2	2	--	All from West Germany.
Cobalt: Oxides and hydroxides	(2)	(2)	NA	NA.
Columbium and tantalum: Metal including alloys, all forms, tantalum	--	(2)	--	All from Switzerland.
Copper: Metal including alloys:				
Ore and concentrate	--	120	--	All from West Germany.
Metal including alloys:				
Unwrought	4	5	--	All from Denmark.
Semimanufactures	198	218	7	West Germany 81; Sweden 63; Finland 17.
Gold: Metal including alloys, unwrought and partly wrought value, thousands	$111	$126	$34	Sweden $27; Netherlands $21.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	23,410	24,862	--	Norway 23,756; Sweden 1,106.
Metal:				
Pig iron, cast iron, related materials	395	327	9	Norway 240; West Germany 64.
Ferroalloys:				
Ferrosilicon	2	NA		
Unspecified	10	6	--	All from U.S.S.R.
Steel, primary forms	744	641	--	Netherlands 241; Belgium-Luxembourg 176; Sweden 130.
Semimanufactures:				
Bars, rods, angles, shapes, sections	17,232	18,952	35	Norway 7,506; Spain 4,738; Belgium-Luxembourg 1,865.
Universals, plates, sheets	12,219	12,863	--	West Germany 3,184; Belgium-Luxembourg 2,480; Sweden 2,133.
Hoop and strip	612	579	3	Denmark 335; West Germany 75; Norway 48.
Rails and accessories	31	68	--	Belgium-Luxembourg 49; Yugoslavia 16; Norway 3.
Wire	245	290	(2)	Belgium-Luxembourg 117; Australia 45; Denmark 35.
Tubes, pipes, fittings	7,599	7,506	175	West Germany 2,333; Netherlands 1,921; United Kingdom 1,001.
Castings and forgings, rough	113	156	1	Belgium-Luxembourg 50; West Germany 40; Denmark 38.
Lead:				
Oxides	13	16	--	West Germany 15; Sweden 1.
Metal including alloys:				
Unwrought	103	246	--	Denmark 231; Sweden 10; United Kingdom 5.
Semimanufactures	21	30	--	West Germany 19; Belgium-Luxembourg 8; Denmark 3.
Magnesium: Metal including alloys:				
Unwrought	88	127	--	Netherlands 66; Norway 61.
Semimanufactures	(2)	(2)	--	NA.
Manganese: Oxides	2	4	--	All from United Kingdom.
Mercury 76-pound flasks	3	3	--	Norway 2; West Germany 1.
Molybdenum: Ore and concentrate	(2)	--		
Nickel: Metal including alloys, semimanufactures	1	3	1	Finland 1; United Kingdom 1.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$125	$141	$4	Switzerland $88; Netherlands $37; West Germany $9.
Silver: Metal including alloys, unwrought and partly wrought do	$124	$89	$2	Sweden $45; United Kingdom $14; Switzerland $8.
Tin: Metal including alloys:				
Scrap	1	4	--	All from Belgium-Luxembourg.
Unwrought	(2)	1	--	Mainly from Denmark.
Semimanufactures	8	9	--	Denmark 5; Belgium-Luxembourg 3; West Germany 1.
Titanium: Oxides	793	505	--	United Kingdom 340; West Germany 110; Norway 55.
Tungsten: Metal including alloys, all forms	(2)	(2)	(2)	Mainly from United Kingdom.
Zinc:				
Oxides	10	11	4	West Germany 6; Norway 1.
Blue powder	6	12	--	Denmark 4; France 4; Norway 3.
Metal including alloys:				
Unwrought	75	71	--	West Germany 36; Norway 20; Belgium-Luxembourg 13.
Semimanufactures	36	29	1	Belgium-Luxembourg 11; West Germany 8; France 7.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Other:				
Ores and concentrates	(2)	--		
Base metals including alloys, all forms	10	13	--	Netherlands 10; Republic of South Africa 2; Switzerland 1.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	26	34	--	Italy 22; Netherlands 9; Norway 3.
Artificial:				
Corundum	(2)	(2)	NA	NA.
Silicon carbide	168	210	--	All from Norway.
Grinding and polishing wheels and stones	30	34	1	West Germany 9; Finland 4; Sweden 4.
Barite and witherite	121	38	--	West Germany 28; Denmark 10.
Boron materials:				
Crude natural borates	10	10	--	All from Denmark.
Oxides and acids	(2)	(2)	--	All from West Germany.
Cement	4,149	181	2	Denmark 75; Belgium-Luxembourg 66; United Kingdom 38.
Chalk	359	290	--	France 92; Norway 78; United Kingdom 76.
Clays, crude	330	327	16	United Kingdom 182; Netherlands 98; Denmark 17.
Cryolite and chiolite	15	20	--	All from West Germany.
Diamond:				
Gem, not set or strung value, thousands	$39	$55	--	Belgium-Luxembourg $34; Switzerland $6; Netherlands $4.
Industrial stones do	$11	$10	--	Belgium-Luxembourg $6; West Germany $2; United Kingdom $2.
Diatomite and other infusorial earth	76	62	--	Denmark 51; Norway 10.
Feldspar, fluorspar, related materials	(2)	(2)	NA	NA.
Fertilizer materials: Manufactured:				
Ammonia	5,029	7,336	--	Norway 7,303; West Germany 22; Denmark 6.
Nitrogenous	143	146	--	Norway 98; West Germany 24; Denmark 21.
Phosphatic	1,800	1,263	--	All from Sweden.
Potassic	9,997	9,871	--	East Germany 6,591; Austria 3,280.
Unspecified and mixed	11,627	13,171	2	Netherlands 12,653; West Germany 398; Denmark 87.
Graphite, natural	11	18	--	All from United Kingdom.
Gypsum and plaster	7,135	4,555	(2)	Sweden 4,489; Denmark 23; Netherlands 19.
Lime	564	510	--	United Kingdom 344; Denmark 105; West Germany 58.
Magnesium compounds	2	2	--	All from West Germany.
Mica:				
Crude including splittings and waste	14	30	--	All from Norway.
Worked including agglomerated splittings	(2)	(2)	--	Mainly from Norway.
Nitrates, crude	5	--		
Phosphates, crude	9	12	--	Norway 6; Denmark 5.
Pigments, mineral: Iron oxides and hydroxides, processed	45	41	--	Denmark 22; West Germany 6; Spain 5.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$6	$19	--	West Germany $10; Belgium-Luxembourg $5; Brazil $2.
Synthetic do	$3	$14	--	West Germany $4; Belgium-Luxembourg $3; Denmark $2.
Pyrite, unroasted	(2)	--		
Salt and brine	71,521	83,525	2	Spain 77,425; West Germany 4,325; Denmark 665.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	1,427	1,493	--	Poland 985; West Germany 178; France 149.
Sulfate, manufactured	109	126	--	Sweden 68; West Germany 30; Denmark 26.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	1,097	213	--	Norway 84; China 68; Portugal 28.
Worked	988	545	--	Italy 270; Portugal 204; Norway 31.
Dolomite, chiefly refractory-grade	607	344	--	Norway 337; Sweden 7.
Gravel and crushed rock	8,615	202	--	Sweden 141; Belgium-Luxembourg 20; Denmark 20.
Limestone other than dimension	250	155	--	Denmark 153; Sweden 2.
Quartz and quartzite	138,670	135,506	40	Norway 112,896; Spain 10,270; Canada 7,105.
Sand other than metal-bearing	365	264	40	Netherlands 82; Belgium-Luxembourg 27.
Sulfur:				
Elemental:				
Crude including native and by-product	(2)	38	--	Denmark 35; United Kingdom 3.
Colloidal, precipitated, sublimed	11	1	--	All from Belgium-Luxembourg.
Dioxide	12	10	4	West Germany 5.
Sulfuric acid	361	312	--	Norway 260; Denmark 43; Netherlands 5.
Talc, steatite, soapstone, pyrophyllite	117	95	--	Norway 91; Denmark 2; Sweden 1.
Other:				
Crude	5	1	(2)	Mainly from Netherlands.
Slag and dross, not metal-bearing	1	171	--	Norway 170; West Germany 1.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	42	63	2	West Germany 30; Belgium-Luxembourg 28; Denmark 3.
Carbon black	22	(2)	--	All from West Germany.
Coal:				
Anthracite	48,684	49,898	45,930	United Kingdom 2,958; West Germany 1,010.
Bituminous	19,934	23,622	18,151	United Kingdom 5,470.
Lignite including briquets	--	1,945	--	All from East Germany.
Coke and semicoke	33,698	39,602	--	Norway 32,683; East Germany 5,238; West Germany 1,597.
Peat including briquets and litter	166	192	--	Finland 94; Sweden 78; Denmark 20.
Petroleum refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	11	11	--	Sweden 4; Netherlands 3; Norway 3.
Gasoline do	805	1,026	--	U.S.S.R. 754; Netherlands 262; Belgium-Luxembourg 10.
Mineral jelly and wax do	3	3	(2)	Denmark 1; West Germany 1; United Kingdom 1.
Kerosene and jet fuel do	515	495	(2)	Netherlands 441; Norway 49; Spain 5.
Distillate fuel oil do	1,905	1,889	--	U.S.S.R. 1,186; Netherlands 547; Norway 109.
Lubricants do	45	53	(2)	Netherlands 13; Belgium-Luxembourg 9; United Kingdom 9.
Residual fuel oil do	666	595	--	All from U.S.S.R.
Bitumen and other residues do	86	111	(2)	Netherlands 65; Sweden 25; Denmark 21.
Bituminous mixtures do	3	2	(2)	United Kingdom 1.
Petroleum coke do	2	--		

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Production of primary aluminum increased by 11% to a record high. After many years of losses, the producer, Icelandic Aluminum Co. Ltd., made a profit, primarily because of the large world price increase for aluminum during the year. Faulty carbon anodes, all imported, caused cell operational difficulties around midyear. The problem was solved and the anode supplier agreed to compensate Icelandic Aluminum, at least partially, for losses incurred.

The 10% reduction in ferrosilicon output occurred because operating difficulties caused 5 weeks of unscheduled downtime.

[1]Physical scientist, Division of International Minerals.
[2]Where necessary, values have been converted from Icelandic krona (IKr) to U.S. dollars at the rate of IKr38.7 = US$1.00.

The Mineral Industry of India

By Gordon L. Kinney[1]

The value of mineral production in 1987 was estimated at $8.2 billion,[2] a 10% improvement over that of 1986. The contribution from crude petroleum was the highest at $4.1 billion. Others, in order of importance, were coal, $3.1 billion; iron ore, $235 million; limestone, $170 million; and lignite, $125 million.

India, the second most populous country in the world, was a major producer of a number of minerals and a major consumer of even more. Barite, cement, chromite, coal, iron ore, limestone, manganese, mica, mineral sands, and nitrogen fertilizer were produced in significant amounts. A considerable amount of aluminum, copper, lead, steel, and zinc was produced but sizable imports of these metals were also needed to meet demand.

Minerals were produced in nearly every State but a few areas contributed heavily. Production from Bombay High offshore oilfields had the highest value, accounting for 34% of the mineral total. It was followed by Bihar, 15%; Madhya Pradesh, 10%; Assam, 9%; Gujarat, 9%; West Bengal, 6%; and Andhra Pradesh 5%.

Some of the major developments during the year included the coming on-line of the National Aluminium Co. Ltd.'s (NALCO) main components. Alumina from the NALCO plant was exported to North Korea and Norway. The first potline of the Angul smelter was being debugged yet produced over 20,000 tons of aluminum ingot.

The Hazira-Bijaipur-Jagdishpur (H-B-J) gas pipeline was connected to the nitrogen fertilizer plant at Bijaipur, Madhya Pradesh, at midyear and then connected to a sister plant in Aonla, Uttar Pradesh, by the end of fiscal year (FY) 1987.[3] The pipeline was one of several projects under way to modernize the movement of gas, crude oil, and refinery products in India. A considerable amount of crude and refined oil products were transported long distances in India by rail and truck.

During 1987, a number of important investigations were conducted by the Geological Survey of India (GSI) such as geological mapping, mineral exploration, and mapping the seabed within the exclusive economic zone (EEZ). Some major achievements were geological mapping of 30,000 square kilometers at a scale of 1:63,360 and drilling 38,000 meters of exploration holes.

In the Burdwan District of West Bengal, core drilling intersected coal seams up to 9.5 meters thick at depths to 480 meters. The most encouraging discoveries were seams 3.1, 2.2, and 1.2 meters thick at depths of 72, 94, and 107 meters, respectively, in the Andal-Palashbari sector. In the Dumka District of Bihar, coal seams up to 15.9 meters thick were intersected to drilling depths of 294 meters. Drilling in the Sundargarh District, Orissa, revealed 15.0-, 19.3-, and 42.2-meter-thick coal seams at depths to 382 meters. Encouraging results were revealed in Khammam District, Andhra Pradesh, where a 16.4-meter seam was struck at a depth of 29 meters.

Exploration for lignite continued in the States of Tamil Nadu and Gujarat. Seams up to 2.4 meters thick were discovered but at depths that apparently were noneconomic.

GSI's most recent exploration work was at Bahoor near Pondicherry, Tamil Nadu, where 30 boreholes delineated a lignite deposit of 330 million tons, and in the West Garo Hills District of Meghalaya, where a 5-meter seam of good quality coal was found at a depth of 30 meters.[4]

The Mineral Exploration Corp. (MEC) is the Government unit that conducts detailed explorations and determines ore reserves after GSI has made the discovery. During 1987, MEC established about 490 million tons of new coking coal reserves, 1 billion tons of noncoking coal, and 380,000 tons of gold ore reserves.

Discoveries in recent years of potentially economic deposits of coal, graphite, limestone, marble, and oil have been made in the northeast in Arunachal Pradesh. Oil India Ltd. (OIL) has started modest crude oil production and Coal India Ltd. (CIL) has been authorized to develop a high-quality coking coal deposit in Tirap District. To exploit the mineral sector as expeditiously as possible, the State Government has set up a mineral organization, Arunachal Pradesh Mineral Development Corp., similar to mineral companies in several other Indian States. The State contributed 0.17% to India's mineral production value, virtually all from the modest flow of crude oil.

In August 1987, India's application for registration as a pioneer investor and its allocation of a mine site in the central Indian Ocean were accepted by the United Nations Preparatory Committee for International Seabed Authority. The United Nations accorded India, along with three other countries, pioneer status in deep seabed exploration. India was the only developing country to be so recognized and became the first to be allocated a 150,000-square-kilometer area for further exploration and development. The pioneer status entitles the country to its site but does not permit commercial exploration until the convention on the law of the sea is effective. India has had an active research program under way since before 1983 and qualified for pioneer status by spending at least $30 million on the program. Extractive processing research on polymetallic nodules was under way at the Regional Research Laboratory in Bhubaneswar, National Metallurgical Laboratory in Jamshedpur, Hindustan Zinc Ltd. in Udaipur and Visakhapatnam, and Hindustan Copper Ltd. (HCL) in Khetri.

India's mineral industry is planning a national drilling center. The United Nations Department of Technical Cooperation for Development will assist in establishing a $5 million center at Nagpur. The center, to be run by MEC, will provide training and drilling technology. It will train technicians from mineral exploration companies, public sector organizations, and mining companies.

In a similar vein, the Oil and Natural Gas Commission plans to create an Institute of Petroleum Safety and Environment Management in Goa at a cost of $7 million. The purpose of the Institute, the first of its kind in Asia, is to raise standards of safety, health, and environmental quality in the petroleum sector.

Electric power shortages have seriously hampered India for the past two decades. Despite the extremely rapid growth of capacity since 1980, the demand for power has grown faster than plants could be built. Power shortages have been exacerbated by 3 years of low rainfall. This has cut hydropower generation while increasing water demand for irrigation. As the farming sector has priority over industry, power for the mineral sector is frequently reduced or cut off. This has reduced metal production considerably. Aluminum, copper, lead, steel, and zinc, primarily, have been affected.

By yearend, power generation capacity in India was 57,000 megawatts consisting of 36,300 megawatts thermal, 19,430 megawatts hydroelectric, and 1,270 megawatts nuclear. The intended installation of 38,000 megawatts of additional capacity during 1990-95 is unlikely to be achieved because of delays in obtaining environmental clearances and inadequate funding. Government experts estimate that new capacity by 1995 is more likely to be 30,000 megawatts. In addition to increasing the power generation capacity, the transmission-distribution network was also to be renovated and extended on a priority basis. The plan required an additional outlay of $50 billion to the year 2000.

PRODUCTION

The most important increases in mineral production during 1987 were coal, copper ore, kyanite, limestone, and zinc concentrate. The most significant declines in mineral production were barite, 37%; crude oil, 3%; and crude mica.

The value of mineral output in the principal producing States, except for Goa and Karnataka, increased in 1987. The most impressive increases were 14% in Assam, 24% in Gujarat, 25% in Maharashtra, 12% in Orissa, and 17% in Uttar Pradesh. The value of mineral output value in Goa and Karnataka declined 20% and 2%, respectively.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987[p]
METALS					
Aluminum:					
Bauxite, gross weight ____ thousand tons	r1,976	r2,093	r2,281	2,338	2,685
Alumina, gross weight ____ do ____	e450	r587	r587	e600	e700
Metal, primary ____	203,559	268,520	260,010	257,096	253,372
Cadmium metal ____	131	148	194	160	214
Chromium: Chromite, gross weight ____	359,932	423,000	560,000	629,671	623,591
Copper:					
Mine output, Cu content ____	37,774	44,132	45,892	48,103	54,835
Metal, primary:					
Smelter ____	3 35,469	40,536	32,460	39,074	32,923
Refinery:					
Electrolytic (cathode) ____	28,368	32,580	28,020	37,853	e33,200
Fire refined[e] ____	1,000	1,000	1,000	1,000	780
Total[e] ____	29,368	33,580	29,020	38,853	33,980
Gold metal, smelter ____ troy ounces	70,158	65,234	58,771	60,250	59,929
Iron and steel:					
Iron ore and concentrate:					
Gross weight ____ thousand tons	38,800	41,026	42,545	47,800	49,411
Iron content ____ do ____	24,289	25,682	26,633	29,923	30,981
Metal:					
Pig iron ____ do ____	9,086	9,382	9,835	10,509	10,893
Ferroalloys:					
Ferrochromium (including charge chrome) ____	35,790	3 55,578	66,497	84,000	93,945
Ferromanganese ____	150,880	3 121,829	163,438	179,132	173,259
Ferrosilicochromium ____	1,675	3 3,892	12,499	e10,000	12,321
Ferrosilicon ____	49,044	3 50,802	39,478	50,096	50,747
Other ____	53	284	e500	e500	529
Steel, crude:					
Steel ingots ____ thousand tons	10,216	3 10,261	10,962	11,332	12,605
Steel castings ____ do ____	89	3 84	92	95	146
Total ____ do ____	10,305	3 10,345	11,054	11,427	12,751
Semimanufactures[4] ____ do ____	3 6,511	3 6,967	3 7,841	7,753	9,790
Lead:					
Mine output, Pb content ____	25,700	24,839	27,085	37,578	e36,725
Metal, refined:					
Primary ____	14,960	15,246	15,567	19,933	20,669
Secondary ____	6,596	e10,000	e10,000	11,300	9,797
Total ____	21,556	3 25,246	3 25,567	31,233	30,466
Manganese:					
Ore and concentrate, gross weight thousand tons	1,281	1,130	1,240	1,213	1,275
Mn content ____	480,811	420,812	461,776	455,287	473,600
Rare-earth metals: Monazite concentrate, gross weight[e] ____	4,000	4,000	4,000	4,000	4,000
Selenium ____ kilograms	3,684	4,191	4,850	r e4,800	4,026
Silver, mine and smelter output thousand troy ounces	469	862	816	1,134	1,220
Titanium concentrates, gross weight:					
Ilmenite ____	3 134,476	e140,000	3 143,000	e140,000	e140,000
Rutile ____	3 5,500	e6,000	3 6,800	e7,000	e7,000
Tungsten, mine output, W content ____	15	21	28	23	26
Zinc:					
Mine output, concentrate:					
Gross weight ____	77,594	85,260	87,082	94,597	102,661
Zn content ____	40,350	44,335	45,283	49,198	53,384
Metal:					
Primary ____	53,268	55,753	70,947	e72,000	68,899
Secondary[e] ____	200	200	200	200	200
Total ____	53,468	55,953	71,147	e72,200	69,099
Zirconium concentrate: Zircon, gross weight ____	11,395	e12,000	14,800	e16,000	e16,000
INDUSTRIAL MINERALS					
Abrasives, natural, n.e.s.:					
Corundum, natural ____	714	442	498	968	496
Garnet ____	3,349	e3,000	5,917	5,366	56,801
Jasper ____	5,418	e5,000	5,078	2,426	3,745
Asbestos ____	24,873	25,450	30,183	25,236	27,019

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987[p]
INDUSTRIAL MINERALS —Continued					
Barite	323,000	446,000	579,742	344,000	211,726
Bromine, elemental[e]	350	350	350	350	350
Cement, hydraulic thousand tons	25,356	29,030	33,050	[3]36,400	36,980
Chalk	91,146	[e]80,000	114,964	106,708	95,156
Clays:					
Ball clay	137,917	[e]135,000	236,625	277,460	252,019
Diaspore	6,361	[e]6,000	9,605	11,580	10,983
Fire clay	657,000	602,000	592,047	583,000	554,824
Kaolin:					
Direct salable, crude thousand tons	553	504	585	733	695
Processed do.	[e]100	116	[e]110	[e]100	[e]150
Total do.	[e]653	620	[e]695	[e]833	[e]845
Other[e] do.	80	80	100	100	100
Diamond:					
Gem[e] thousand carats	12	13	14	13	16
Industrial[e] do.	2	2	2	[r]3	3
Total do.	14	15	16	16	19
Feldspar	41,837	39,943	46,101	46,288	49,663
Fluorspar:					
Concentrates:					
Acid-grade	[e]11,000	[e]12,000	11,107	[r e]7,624	[e]8,261
Metallurgical-grade	4,590	[e]5,000	[e]5,000	[r e]4,109	[e]4,448
Total	[e]15,590	[e]17,000	[e]16,107	11,733	12,709
Other fluorspar materials, graded	6,993	4,232	[e]4,000	6,841	5,748
Gem stones excluding diamond:					
Agate including chalcedony pebble	502	[e]1,000	750	776	752
Garnet kilograms	735	[e]2,000	2,399	5,021	2,007
Graphite[e]	39,567	38,986	27,337	38,412	26,864
Gypsum	1,039,000	1,378,000	1,260,369	1,549,000	1,861,000
Kyanite and related materials:					
Andalusite	2,573	2,700	504	732	482
Kyanite	38,307	37,024	30,472	32,394	37,382
Sillimanite	7,928	13,377	17,095	14,905	14,366
Lime[e]	400,000	500,000	500,000	600,000	700,000
Magnesite	434,072	414,029	417,412	422,000	419,933
Mica:[e 7]					
Exports:					
Block	1,100	1,100	1,200	1,200	1,200
Film and book for mica cuttings	200	200	250	250	250
Splittings	3,000	3,000	4,000	4,000	4,000
Scrap	7,000	7,000	11,000	11,000	11,000
Powder	4,000	4,000	4,700	4,700	4,700
Manufactured	500	500	1,000	1,000	1,000
Total	15,800	15,800	22,150	22,150	22,150
Domestic use, all forms	3,000	3,000	3,500	3,500	4,000
Total mica	18,800	18,800	25,650	25,650	26,150
Nitrogen: N content of ammonia[3] thousand tons	3,565	3,975	4,324	5,410	4,742
Phosphate rock including apatite	687,907	892,000	929,098	667,070	679,419
Pigments, mineral, natural: Ocher	88,633	107,852	108,549	98,668	145,245
Pyrites, gross weight	63,621	44,238	17,744	20,773	29,486
Salt:					
Rock salt thousand tons	4	5	4	2	1
Other do.	7,008	7,723	9,875	10,116	9,900
Total do.	7,012	7,728	9,879	10,118	9,901
Sodium carbonate	744,329	830,863	813,600	873,600	969,600
Stone, sand and gravel:[8]					
Calcite	[e]20,000	[e]20,000	26,049	26,318	36,282
Dolomite thousand tons	2,264	2,277	2,217	2,139	2,178
Limestone do.	36,965	45,483	48,070	52,562	56,680
Quartz and quartzite do.	[e]300	[e]300	259	274	227
Sand:					
Calcareous do.	598	570	706	571	112
Other do.	1,018	[e]1,200	2,349	1,113	1,761
Slate	3,461	[e]5,000	5,529	6,483	2,312

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987[p]
INDUSTRIAL MINERALS —Continued					
Sulfur:					
Content of pyrites	25,448	17,695	7,098	8,309	11,794
Byproduct:					
From metallurgical plants[e]	110,000	115,000	120,000	120,000	120,000
From oil refineries	3,906	[e]5,000	305	[e]1,000	--
Total[e]	139,354	137,695	127,403	129,309	131,794
Talc and related materials:					
Pyrophyllite	59,042	84,159	53,741	53,005	51,724
Steatite (soapstone)	294,000	333,576	329,192	343,000	359,448
Vermiculite	2,411	1,953	1,805	6,681	2,439
Wollastonite	16,557	[e]20,000	26,040	23,770	31,021
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Bituminous thousand tons	136,261	145,800	149,259	162,800	177,220
Lignite do	7,342	7,500	7,774	7,900	8,311
Total do	143,603	153,300	157,033	170,700	185,531
Coke:[e]					
Coke oven and beehive do	12,000	12,000	13,000	13,000	13,000
Gashouse do	100	100	100	100	100
Other, soft do	50	50	100	200	200
Total do	12,150	12,150	13,200	13,300	13,300
Gas, natural:					
Gross million cubic feet	210,550	255,700	287,200	[e]360,000	[e]350,000
Marketable[9] do	100,860	114,420	133,561	232,090	223,685
Petroleum:					
Crude thousand 42-gallon barrels	184,440	204,943	219,132	228,416	220,929
Refinery products:					
Gasoline do	27,100	[e]26,000	[r e]34,000	[e]42,000	[e]47,000
Kerosene and jet fuel do	27,900	[e]27,000	[r e]38,000	[e]45,000	[e]50,000
Distillate fuel oil do	87,200	[e]84,000	[r e]95,000	[e]110,000	[e]116,000
Residual fuel oil do	53,600	[e]51,000	[r e]63,000	[e]58,000	[e]59,000
Lubricants do	3,200	[e]3,000	3,000	[e]3,000	[e]4,000
Other do	43,600	[e]42,000	[r e]50,000	[e]55,000	[e]56,000
Refinery fuel and losses do	20,200	[e]19,000	[r e]28,800	[r e]21,660	[e]23,100
Total do	262,800	[e]252,000	[r]305,800	[r]334,660	357,100

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

[1]Table includes data available through Sept. 15, 1988.

[2]In addition to the commodities listed, other clays (bentonite, common clay, and fuller's earth), 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 metric tons of uranium ore containing about 3 metric tons of U_3O_8 was reported from two mines, which was only a part of total national production. Reported production values for sand and gravel and stone 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, and 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]Excludes production from steel miniplants.

[5]Official Indian Bureau of Mines figure is thought to be production from Government-owned operations. Private Indian production brings 1987 total to more than 20,000 tons.

[6]India's marketable production is 10% to 20% of mine production.

[7]Data supplied here (exports plus domestic use) are provided in lieu of officially reported production because the latter figures are evidently incomplete. Officially reported production figures are as follows, in metric tons: 1983—7,364; 1984—7,171; 1985—6,965; 1986—4,684; and 1987—4,240.

[8]Partial figures; for details, see footnote 2.

[9]Includes reinjected gas.

TRADE

In FY 1984, the most recent year for which detailed trade statistics are available, the value of mineral exports was $2.85 billion, or 29% of merchandise trade. The value of mineral exports increased strongly during FY 1981-83. In FY 1984, exports, by value, of crude oil, cut and polished diamonds, iron ore, building and monument

stone, mica, chromite, manganese ore, other gem stones, barite, alumina, and emeralds accounted for 97% of the value of mineral exports. In FY 1987, diamond had the highest value of mineral exports. Crude oil had been exported because Indian refineries were unable to refine Bombay High oil. All Indian refineries have now been modified to process Bombay High oil; consequently, crude oil exports were estimated to have dropped to a low level. Emerald production was also thought to have declined to an insignificant level. Modern cutting and polishing equipment has been introduced into some marble and granite quarries, which has probably increased production volume and value. With completion of the NALCO project, exports of alumina should show a large increase beginning in 1988.

Minerals were exported to 88 countries in FY 1984. The major recipients of these minerals, excluding petroleum, were the United States, 31%; Japan, 29%; Belgium, 8%; and Hong Kong, 7%. Others receiving 2% to 4% of India's exports were Italy, the Republic of Korea, Romania, Singapore, Switzerland, and the U.S.S.R.

Exports of metals and alloys accounted for 1% of India's export trade value. Iron and steel, including scrap, made up 80% of these exports, followed by aluminum and copper, mainly as brass and bronze.

Imported minerals, 29% of India's imports, were valued at $4.2 billion in FY 1984. Crude petroleum accounted for 69% of imported minerals; rough diamond, 20%; sulfur 4%; and rock phosphate, 3%. Saudi Arabia was India's principal mineral importer at 24%, followed by the U.S.S.R., 16%; Iraq, 14%; and Belgium, 11%.

Imports of metals and alloys were valued at $1.29 billion or 9% of India's imports. Iron and steel, including scrap, accounted for 65%; copper, 9%; aluminum, 7%; zinc, 5%; and ferroalloys and nickel, 4% each.[5] Imports of metals and alloys have tended to vary considerably because production losses caused by inadequate electric power were generally offset by imports.

In light of increased domestic production, imports of steel dropped from 2.2 million tons in FY 1986 to 1.9 million tons in FY 1987. The major categories of those imports in FY 1987 were skelp, hot- and cold- rolled coil and sheet, and tin mill black plate. Here again, the steel import mix varied considerably as semimanufactures, structurals, plates, and stainless and alloy steels dropped precipitously from FY 1986 levels.

Table 2.—India: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983-84	1984-85	Destinations, 1984-85	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	118,867	61,547	--	United Arab Emirates 44,547; Saudi Arabia 17,000.
Oxides and hydroxides	37,805	49,474	--	U.S.S.R. 48,993; Japan 430.
Metal including alloys, all forms	6,916	5,598	249	U.S.S.R. 3,408; Bangladesh 758.
Cadmium: Metal including alloys, all forms	--	12	--	All to United Arab Emirates.
Chromium:				
Ore and concentrate	103,386	238,387	--	Japan 208,387; Philippines 15,500.
Metal including alloys, all forms	7,604	--		
Copper:				
Ore and concentrate	17	18,746	--	West Germany 9,715; Republic of Korea 9,031.
Metal including alloys, all forms	1,353	1,325	68	Iran 661; U.S.S.R. 342.
Iron and steel:				
Iron ore and concentrate including roasted pyrite thousand tons	22,073	25,527	NA	Japan 16,254; Romania 3,403; Republic of Korea 3,015.
Metal:				
Scrap	57,615	52,449	NA	Philippines 25,137; Japan 25,096.
Pig iron, cast iron, related materials	695	1,466	1,030	Oman 222; Nigeria 80.
Ferroalloys:				
Ferromanganese	--	1,950	--	All to Netherlands.
Silicon metal	2	8	--	All to United Kingdom.
Unspecified	--	42	--	NA.
Steel, primary forms	97,535	197,103	27,212	U.S.S.R. 75,629; Saudi Arabia 23,838; China 18,050.

See footnotes at end of table.

Table 2.—India: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983-84	1984-85	Destinations, 1984-85	
			United States	Other (principal)
METALS —Continued				
Lead: Metal including alloys, all forms	5	65	--	Bangladesh 52.
Manganese:				
Ore and concentrate, metallurgical-grade	358,442	621,432	--	Japan 306,256; Republic of Korea 101,101; Romania 73,147.
Oxides	214	204	--	Sri Lanka 164; France 22.
Metal including alloys, all forms	2	10	--	All to Thailand.
Nickel: Metal including alloys, all forms	10	76	--	U.S.S.R. 62; Oman 8.
Selenium, elemental	28	18	--	Hungary 10; Sri Lanka 4.
Tin:				
Ore and concentrate	--	50	--	All to Malaysia.
Metal including alloys, all forms	415	607	--	Nepal 117; United Kingdom 98; Kenya 88.
Titanium:				
Ore and concentrate	176,111	125,131	--	Japan 34,735; West Germany 29,332; France 28,100.
Oxides	20	--		
Tungsten: Metal including alloys, all forms	(2)	4	--	All to Bangladesh.
Vanadium: Ore and concentrate[3]	54	202	--	West Germany 200.
Zinc: Metal including alloys, all forms	127	36	--	Belgium-Luxembourg 17; Sri Lanka 8.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Natural: Corundum, emery, pumice, etc	647	1,127	NA	NA.
Asbestos, crude	79	158	--	West Germany 68; Czechoslovakia 44.
Barite and witherite	120,580	347,317	248,001	United Arab Emirates 76,549; U.S.S.R. 10,000.
Boron materials:				
Sodium borate	537	279	--	Singapore 140; Sri Lanka 87.
Oxides and acids	13	34	--	Netherlands 15; Bangladesh 11.
Cement	8,505	21,543	NA	Nepal 6,629; unspecified 14,914.
Chalk	91	73	--	Bangladesh 62.
Clays, crude:				
Bentonite	21,079	69,170	--	United Arab Emirates 34,356; Kuwait 17,463.
Fire clay	471	1,100	--	U.S.S.R. 500; Kenya 283; Bangladesh 200.
Kaolin	5,664	5,307	--	Bangladesh 3,728; Syria 800; Japan 650.
Unspecified	452	596	31	Sweden 210; Bangladesh 189.
Diamond: Gem, not set or strung value, thousands	$1,135,779	$955,236	$451,169	Japan $131,847; Belgium-Luxembourg $122,032.
Feldspar	14,569	37,689	--	Bangladesh 19,543; Malaysia 7,375; Taiwan 4,089.
Graphite, natural	1,188	1,876	531	Japan 334; Singapore 264; Taiwan 250.
Gypsum and plaster	519	18,565	--	Sri Lanka 18,101; Nepal 464.
Kyanite and related materials: Sillimanite	150	--		
Magnesium compounds: Oxides and hydroxides	1,447	3,030	--	United Kingdom 2,214; Japan 816.
Mica:				
Crude including splittings and waste	12,430	16,430	4,606	Japan 2,970; Belgium-Luxembourg 2,456.
Worked including agglomerated splittings	13,076	13,125	1,180	Norway 2,391; West Germany 2,216; Japan 1,709.
Phosphorus, elemental	58	54	--	All to Nepal.
Pigments, mineral:				
Natural, crude	78	360	--	Philippines 142; West Germany 76.
Iron oxides and hydroxides, processed	3,649	5,190	--	Philippines 1,367; United Kingdom 861; Kenya 641.
Precious and semiprecious stones other than diamond: Natural:				
Emerald value, thousands	$3,615	$2,940	$656	Singapore $843; Switzerland $432.
Other do	$23,865	$12,454	$3,931	Hong Kong $1,349; Japan $872; Switzerland $820.
Salt and brine	116,221	29,684	--	Bangladesh 20,220; Singapore 7,500.
Sodium compounds, n.e.s.: Carbonate, manufactured	148	7	NA	NA.
Stone, sand and gravel:				
Dimension stone, all forms	379,943	489,155	2,435	Japan 203,628; Italy 139,925.
Dolomite, chiefly refractory-grade	3,835	2,142	--	Bangladesh 2,098.
Limestone other than dimension	105,917	187,255	NA	Bangladesh 175,678.
Quartz and quartzite	28,382	53,784	--	Japan 51,910; Bangladesh 1,749.
Sand other than metal-bearing	7,349	9,075	--	Japan 4,831; United Arab Emirates 2,657.

See footnotes at end of table.

Table 2.—India: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983-84	1984-85	Destinations, 1984-85	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur: Elemental, crude including native and byproduct	--	22	--	All to Nepal.
Talc, steatite, soapstone, pyrophyllite	9,635	12,563	NA	Kenya 2,839; Norway 2,810; Bangladesh 1,087.
Vermiculite	2,874	465	--	Kuwait 200; Japan 102; Sri Lanka 100.
MINERAL FUELS AND RELATED MATERIALS				
Coal, all grades including briquets thousand tons	55	100	--	Bangladesh 52; Nepal 48.
Coke and semicoke	44	353	--	All to Nepal.
Petroleum:				
Crude thousand 42-gallon barrels	41,089	48,203	NA	NA.
Refinery products:[4]				
Light distillates:				
Naphtha do.	7,658	5,202	NA	NA.
Other do.	110	119	NA	NA.
Middle distillates do.	821	985	NA	NA.
Heavy ends do.	2,984	1,166	NA	NA.

NA Not available.
[1]Table prepared by Audrey D. Wilkes. Data are for Indian fiscal year Apr. 1 through Mar. 31. Data in this table have been compiled from the Indian Minerals Yearbook 1986.
[2]Less than 1/2 unit.
[3]May include other unspecified ores.
[4]Defined as provided in data source.

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

(Metric tons unless otherwise specified)

Commodity	1983-84	1984-85	Sources, 1984-85	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	1,015	971	23	France 409; West Germany 212; Netherlands 167.
Metal including alloys, all forms	26,326	61,794	2,040	Bahrain 20,426; U.S.S.R. 9,781; United Arab Emirates 7,322.
Antimony:				
Ore and concentrate	--	103	--	All from Thailand.
Metal including alloys, all forms	511	352	--	China 271; Taiwan 50.
Arsenic: Oxides and acids	39	5	NA	NA.
Cadmium: Metal including alloys, all forms	113	20	--	Australia 18.
Chromium:				
Ore and concentrate	36	--		
Metal including alloys, all forms	49	73	--	United Kingdom 69.
Cobalt: Metal including alloys, all forms	155	116	4	Zaire 53; Belgium-Luxembourg 16; Zambia 16.
Copper: Metal including alloys, all forms	120,854	80,138	2,559	Zambia 29,513; Zaire 6,588; Japan 5,947.
Iron and steel:				
Iron ore and concentrate including roasted pyrite	52	--		
Metal:				
Scrap	802,453	618,646	205,472	Netherlands 148,148; West Germany 109,683.
Pig iron, cast iron, related materials	315,207	3,546	--	Japan 2,550; Canada 361; Brazil 321.
Ferroalloys:				
Ferrochromium	18,841	9,172	85	West Germany 6,523; Sweden 1,723.
Ferromanganese	1,350	811	--	West Germany 520; France 158.
Ferromolybdenum	5	10	2	United Kingdom 6.
Ferronickel	18,860	19,036	1,378	Colombia 3,885; France 3,041; New Caledonia 2,498.
Ferrosilicochromium	10	5	--	All from West Germany.
Ferrosilicomanganese	413	--		
Ferrosilicon	363	129	5	France 64; United Kingdom 40.
Silicon metal	1,374	1,387	28	France 446; Norway 407; Canada 157.
Unspecified	56	5	--	All from United Kingdom.
Steel, primary forms	2,114,430	1,842,312	31,309	Japan 508,777; West Germany 454,639.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983-84	1984-85	Sources, 1984-85	
			United States	Other (principal)
METALS —Continued				
Lead:				
Ore and concentrate	2,957	10,097	--	Canada 7,177; Belgium-Luxembourg 2,362.
Metal including alloys, all forms	43,338	42,902	NA	Australia 32,595; Netherlands 5,009.
Magnesium: Metal including alloys, all forms	563	634	63	Norway 368; France 143.
Manganese:				
Ore and concentrate:				
Battery-grade	973	106	--	All from Singapore.
Metallurgical-grade	2,790	3,841	--	Singapore 2,516; Gabon 1,305.
Oxides	454	285	10	Japan 181; Belgium-Luxembourg 94.
Metal including alloys, all forms	811	217	18	France 70; China 61.
Molybdenum: Metal including alloys, all forms	23	5	1	Austria 2; Netherlands 2.
Nickel:				
Ore and concentrate	2,215	1,589	95	Cuba 700; Canada 292; Netherlands 192.
Metal including alloys, all forms	11,304	11,881	726	U.S.S.R. 2,387; Norway 1,671; Canada 1,095.
Platinum-group metals: Metals including alloys, unwrought and partly wrought troy ounces	5,787	6,044	--	U.S.S.R. 3,568; United Kingdom 2,476.
Selenium, elemental	12	2	--	Bulgaria 1; Japan 1.
Silver: Metal including alloys, unwrought and partly wrought troy ounces	37,745	8,584	161	West Germany 5,530; Switzerland 1,093.
Tin:				
Ore and concentrate	1	--		
Metal including alloys, all forms	7,050	17,187	1,423	United Kingdom 7,358; France 1,996.
Titanium:				
Ore and concentrate	45	229	--	Sri Lanka 200.
Oxides	14,445	10,376	4,017	United Kingdom 2,123; West Germany 1,129.
Tungsten:				
Ore and concentrate	522	212	--	Burma 128; Norway 40.
Metal including alloys, all forms	41	22	4	Belgium-Luxembourg 6; Japan 6.
Vanadium: Ore and concentrate[2]	498	604	42	United Kingdom 248; West Germany 117; Canada 60.
Zinc:				
Ore and concentrate	11,784	4,955	72	Australia 4,817.
Metal including alloys, all forms	81,022	63,887	1,269	Zambia 10,233; Finland 8,602; Zaire 6,980.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Natural: Corundum, emery, pumice, etc	NA	10	NA	NA.
Asbestos, crude	87,264	68,827	--	Canada 38,971; U.S.S.R. 16,914; Brazil 4,919.
Boron materials: Crude natural borates	26,179	11,813	5,889	Turkey 5,810.
Cement	1,548,378	267,812	6,860	Romania 134,847; Poland 40,794.
Clays, crude:				
Bentonite	57	12	--	Mainly from United Kingdom.
Kaolin	54	107	4	United Kingdom 102.
Unspecified	1,324	1,141	322	United Kingdom 402; Japan 200.
Diamond:				
Gem, not set or strung value, thousands	$1,040,360	$855,313	NA	Belgium-Luxembourg $465,696; United Kingdom $285,491.
Industrial stones do.	$872	$197	$25	Belgium-Luxembourg $90; United Kingdom $37.
Diatomite and other infusorial earth	106	8	8	
Fertilizer materials: Manufactured:				
Phosphatic[3]	142,600	745,200	NA	NA.
Potassic	701,937	1,030,853	16,521	Canada 422,917; West Germany 369,824.
Fluorspar	20,643	12,824	--	Thailand 11,918; China 449.
Graphite, natural	520	245	1	Sri Lanka 108; Japan 60.
Gypsum and plaster	--	9	9	
Magnesium compounds:				
Magnesite, crude	37	2	--	Mainly from Netherlands.
Oxides and hydroxides	16,077	4,805	--	United Kingdom 2,082; Japan 1,235; Netherlands 1,094.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983-84	1984-85	Sources, 1984-85	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Mica:				
Crude including splittings and waste	--	3	--	All from United Kingdom.
Worked including agglomerated splittings	36	12	--	Switzerland 7; United Kingdom 2.
Phosphates, crude thousand tons	1,440	1,593	339	Jordan 848; Morocco 268.
Phosphorus, elemental	7	96	--	Netherlands 90.
Pigments, mineral:				
Natural, crude	2	19	19	
Iron oxides and hydroxides, processed	213	370	51	United Arab Emirates 200; West Germany 95.
Potassium salts, crude	6,500	13,000	--	All from West Germany.
Precious and semiprecious stones other than diamond: Natural:				
Emerald value, thousands	$10,709	$7,577	$2,303	Switzerland $1,222; Hong Kong $871.
Other do	$4,457	$1,756	$273	Singapore $506; Brazil $267.
Salt and brine	7,111	7,353	--	Pakistan 7,295.
Stone, sand and gravel:				
Dimension stone, all forms	2,530	60,395	--	Italy 59,003.
Quartz and quartzite	26	NA		
Sand other than metal-bearing	3,479	2,016	179	Australia 757; Singapore 468; Sri Lanka 261.
Sulfur: Elemental:				
Crude including native and byproduct	808,423	1,153,089	89,342	Canada 546,530; Saudi Arabia 300,612.
Colloidal, precipitated, sublimed	118	221	120	France 72.
Talc, steatite, soapstone, pyrophyllite	22	15	--	All from Nepal.
MINERAL FUELS AND RELATED MATERIALS				
Coal, all grades including briquets	360,605	543,177	--	Mainly from Australia.
Coke and semicoke	115	17,165	--	Australia 16,500; Japan 662.
Petroleum, crude thousand 42-gallon barrels	117,888	98,430	--	Saudi Arabia 33,204; U.S.S.R. 22,881; Iraq 19,780.

NA Not available.

[1]Table prepared by Audrey D. Wilkes. Data are for Indian fiscal year Apr. 1 through Mar. 31. Data in this table have been compiled from the Indian Minerals Yearbook 1986.

[2]May include other unspecified ores.

[3]P_2O_5 content. Data from The Fertiliser Association of India, New Delhi. Fertiliser Statistics, 1984-85, p. I-190.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—The Reserve Bank of India approved the U.S.-based Kaiser Aluminum and Chemical Corp.'s proposal to withdraw its 26% equity from the private sector Hindustan Aluminium Corp. (HINDALCO). HINDALCO, incorporated 25 years ago, is a part of the Birla Group. Kaiser owned 3.57 million shares of the company and proposed to offer them to the other shareholders at less than one-half the market price. The Indian Government's tight controls on aluminum distribution and pricing appeared to have prompted Kaiser's withdrawal. Kaiser had been considering such a move for a number of years.

Bharat Aluminium Co. Ltd.'s (BALCO) captive powerplant began to generate electricity during 1987. Three 67.5-megawatt turbogenerators were brought on-line in June, September, and November. The fourth unit had fallen behind schedule and was to be brought on-line in spring 1988. The cost of the powerplant escalated from $259 million in August 1985 to $400 million. Critical power shortages have severely cut BALCO's aluminum production for many years.

The committee studying the ecology and environmental effects of the long-delayed Gandhamardan bauxite mine submitted a favorable report to the Department of Environment in January 1987. The Department of Environment gave conditional clearance for the project in October, pending final approval by an Environmental Management Authority formed for the purpose. The 5-year delay has caused the cost of the project to double to more than $50 million.

The completion of this fully mechanized 600,000-ton-per-year mine has been delayed

by land acquisition problems, environmental concerns, and agitation by local residents. Any further delays will adversely affect BALCO's operations. Reserves at the company's mines at Amarkantak and Phutkapahar in Madhya Pradesh were expected to be exhausted by 1990.

The feasibility study by the Soviet agency Tsvetetromoexport on the Andhra Pradesh bauxite mine was submitted to the Steel and Mines Minister and was awaiting action. The mine was to have a capacity of 2.3 million tons per year. An agreement was signed in Moscow between NALCO and the Institute of Aluminum, Magnesium, and Electrode Industry of Leningrad. It provided for the use of Soviet equipment and credit once approved by the Indian Government. The bulk of the ore would be exported to the U.S.S.R.

The giant NALCO complex in Orissa continued shakedown operations as each major component was brought into commercial production. Production at the $68 million mine was being increased slowly to its 2.4-million-ton capacity. The reserves of more than 317 million tons were deemed to be recoverable as the overburden is only 1 meter thick.

The second-phase production line at the $585 million Damanjodi alumina plant was commissioned. The work force at Damanjodi was 800, of which 100 were management and office staff. The plant had 51 megawatts of captive power installed at a cost of $115 million. By May 1987 the plant had produced 126,000 tons of alumina, of which 85,000 tons had been exported. NALCO planned to export 375,000 tons per year from the Visakhapatnam port with the remaining 425,000 tons going to its Angul smelter. The smelter's first potline was tested in March and began commercial production in April. The $554 million smelter was rescheduled to attain its full capacity of 218,000 tons in 1989 and would employ 3,500 workers. The smelter was still in the shakedown phase. Production for the first 11 months was 20,000 tons of ingot. Energy consumption, reportedly, was highly efficient at 13,000 to 13,400 kilowatt hours per ton of metal. The smelter and powerplant are at the coal rather than the bauxite supply mine site. In this case, the coal for generating the required 600 megawatts is of poor quality, averaging 43% ash. Shipping lower tonnages of alumina to Angul was considered much more economical.

The powerplant and coal mine were major costs and key features of the NALCO project. The powerplant was estimated to cost $623 million. It employed 900 workers and would employ 1,100 when all of the generators are installed. Five 120-megawatt generators were authorized and an application for a sixth was submitted for approval to the Government. The first generator was constructed in the Federal Republic of Germany. About 60% of the second generator was manufactured in the Federal Republic of Germany with the remainder finished in India. Both of these units were installed by yearend. The No. 4 and No. 5 units were being constructed entirely in India but the controls were purchased from the Federal Republic of Germany. The plant required four units for normal operation, with the fifth used as a backup. The plant managers were fearful, however, that frequent power outages in Orissa would cause the local government to pressure them to provide power for other uses. The powerplant is served by a captive railroad which delivers 1,800 tons per day of coal for each generator. The NALCO complex was the only aluminum plant in India to be totally independent for its raw material and power needs. At yearend, NALCO was granted a license for a 30,000-ton-per-year aluminum-alloy wire plant at Angul.

A new 200,000-ton-per-year smelter was being planned for Sindri in Bihar State. The plant would be a downstream development of the Mukunda Coalfield development program in Dhanbad District, which was being set up under a Indo-Soviet agreement. The coalfield, electric powerplants, bauxite mine, and aluminum plants would be an economic stimulus to this underdeveloped area.

Chromite.—OMC Alloys Ltd., a subsidiary of Orissa Mining Corp. Ltd., began operating its pellet roasting kiln in April. Orissa Mining planned to construct India's third chromite beneficiation plant in South Kaliapani, the second such plant in Orissa. It also planned to build a briquetting plant. The 84,000-ton-per-year beneficiation plant would process low-grade ore of less than 50% Cr_2O_3, and the briquetting plant would process high-grade ore. The briquetting plant was to produce 50,000 tons per year and feed several local ferrochromium plants. Completion of both plants was scheduled for 1989. These plants are part of India's trend to produce higher value ferrochromium for export.

Tata Iron and Steel Co. Ltd. (TISCO) started expansion of its Sukinda chromite mine and installation of a plant to treat

low-grade ore. The plant feed was to average 20% Cr_2O_3 and the product about 50% Cr_2O_3. Plant equipment was to be supplied by Sala International of Sweden and Mineral Deposits Ltd. of Australia.

Indian Metals and Ferro Alloys Corp. Ltd. (IMFA) continued construction of the 50,000-ton-per-year Indian Charge Chrome Ltd. (ICCL) charge chrome plant and a 108-megawatt coal-fired powerplant. ICCL expected to complete the plants in late 1988. IMFA had ferrochromium plants at Therubali and Choudhar. The Therubali plant produced ferrochromium for domestic consumption and the Choudhar plant was closed pending adequate power supply.

Ferro Alloys Corp. Ltd.'s ferrochromium plant at Shreeramnagar in Andhra Pradesh was subjected to a 40% electric power reduction during 1987 because of regional drought.

Copper.—The modernization program begun in 1986 at Khetri Copper Complex (KCC) was continued. The waste heat boiler was restored to its original capacity after modification and repair. The replacement of the refractory lining of the flash furnace and modification of the second anode furnace were under way. Installation of a new type of sulfur burner in the off-gas recovery plant was completed.

The Mosaboni Mine at the Indian Copper Complex (ICC) in Singhbhum District, Bihar, was being expanded from 50,000 to 80,000 tons per month at a revised cost of more than $6 million. The Kendadih Mine, which started out as an exploratory working, was being expanded to a capacity of 400 tons per day. It was also decided to develop the Chhapri and Sidheswari Mines and eventually to replace an old uneconomic mine with these new mines. To offset continuing power supply problems, HCL was adding another 4.4-megawatt turbogenerator to bring total captive power at ICC to 22.8 megawatts.

India's objective of substantially increasing copper production depends upon a huge expansion of the Malanjkhand Mine. The Japanese Government has offered substantial financial aid through its Overseas Economic Cooperation Fund to cover engineering services. The loan would allow Japan's mining and engineering firms to compete for a feasibility report, which should be completed by early 1990. The plan is to expand the 2-million-ton-per-year ore capacity to between 14 and 16 million tons per year, thus yielding a copper content of more than 100,000 tons.

HCL also planned to construct a natural gas-fueled continuous-cast copper wire rod plant at Taloja, Maharashtra. It is to have an annual capacity of 60,000 tons and is estimated to cost $14 million. Southwire Technology Inc. of the United States has reportedly received a letter of intent to build the plant and to supply the machinery and technology. India's annual demand for copper metal was 125,000 tons, leaving a shortage of 85,000 tons that must be imported. Prospects for reducing imports were minimal, barring the discovery of a large high-grade deposit. Minerals and Metals Trading Corp. (MMTC) supervised imports of copper as nearly 90% was routed through it, with the balance imported by a few authorized companies that use copper to manufacture products for export. MMTC was authorized to import 80,000 tons of copper in FY 1988.

India's projected demand for copper is 150,000 tons for FY 1989, increasing to 200,000 tons by FY 2000. Domestic production in FY 1989 and FY 2000 was projected to be 60,000 tons and 75,000 tons, respectively. The increase was to come mostly from the Malanjkhand Mine expansion and from marginal increases at the Bihar and Rajasthan Mines.

Iron and Steel.—India's demand for steel has been rising erratically but constantly for years. The industry suffers from various cultural, financial, political, and technical problems. The Government-owned Steel Authority of India Ltd. (SAIL) was in the middle of a huge modernization and expansion program while trying to resolve the problems. The major problems were as follows: (1) a chronic instability of domestic demand, (2) poor quality of raw materials, especially coal, which lowered the quality and increased the cost of steel production, (3) chronic electric-power shortages, and (4) excessive work force, which further increased costs. In addition, the public sector plants under SAIL suffered from old technology and equipment, high energy consumption, inefficient management, and an inability to adjust the product mix or rolling mill programs in response to changes in demand.[6]

The shortage of electric power at SAIL steel plants between April 1986 and June 1987 has caused the loss of over 500,000 tons of crude steel. To help insulate SAIL plants against power shortfalls, the Government approved additional captive power facilities at Bokaro, Durgapur and Rourkela. When completed, about two-thirds of SAIL's pow-

er requirements will be met by captive powerplants, which is double the previous amount. TISCO had captive power of 132 megawatts and planned to increase this by 60 megawatts by 1988. It further proposed to add 120 megawatts of captive power to meet the demand of producing an additional 1 million tons of steel by 1990.

As of March 1986, the work force of SAIL was 208,000. About 50,000 surplus workers who cannot be laid off because of labor rules were expected to retire within 10 years; meanwhile, SAIL will continue to have excessive labor costs. TISCO, also having surplus workers, planned to retrain and reassign them to new facilities. The voluntary retirement schemes of SAIL and TISCO have been unsuccessful to date.

Differences in technology, maintenance programs, and management had led to different rates of capacity utilization (RCU) and profits for SAIL and TISCO plants that have capacities of, 7.2 and 1.7 million tons per year of salable steel respectively. The Government exempted SAIL from contributing to the Steel Development Fund, a statutory obligation, and waived interest on its Government loans. Despite this, SAIL, with an RCU of 83% in FY 1986, declared a profit of $83 million. In contrast, privately owned TISCO, a much smaller company, operated at an RCU of 109%, earning a profit of $79 million in FY 1986. Both company's profits were sharply lower than those of FY 1985 because of a steep rise in input costs of raw materials, supplies, and energy.

Steel prices in India have not increased since February 1985. But, according to industry estimates, production costs have gone up $44 to $51 per ton of raw steel. Since then costs have increased for power, 14%; coal, 33%; and railway transportation, 37%. Wage rates costs were also expected to go up. The rates were being negotiated at yearend with the results to be retroactive to September 1, 1986.

SAIL's priority was to accelerate the application of new technology in its existing plants and to raise production from 6.3 million tons in FY 1986 to 15 million tons by FY 2000. The expansions of the Bhilai and Bokaro steel plants have been delayed by 4 and 6 years, respectively. SAIL expected the Bhilai plant's expansion from 2.5 to 4.0 million tons of liquid steel and 3 million tons of salable steel to be completed by February 1988. The cost of this expansion rose from $937 million to $1.8 billion. Despite the expenditure, the Bhilai plant will not be able to produce at rated capacity because of imbalances in different sectors of the plant. The Bokaro plant expansion to 4 million tons of liquid steel was scheduled for completion by September 1988 at a cost of $1.7 billion compared with the original estimate of $1.0 billion. SAIL plans, with assistance from the U.S.S.R., to further expand the Bokaro plant capacity to 4.5 million tons.

The cost of modernizing the Durgapur steel plant, revised twice since 1984, was estimated to be $1 billion. The plan to increase capacity of liquid steel from 900,000 to 1,600,000 tons per year was approved by the Government.

The Japanese Iron and Steel Federation has recommended a $2.3 billion modernization and expansion for Indian Iron and Steel Co.'s (IISCO) Burnpur plant in West Bengal. The plan would raise the capacity from 500,000 to 2,150,000 tons in two stages and make IISCO internationally competitive in both price and quality. The Japanese International Cooperation Agency was reportedly willing to fund a major portion of the program.

Japan's Nippon Steel Co. has proposed to take equity in the project. The proposal was politically controversial and received a mixed response from various high-level Indian Government officials.

SAIL planned a $1.2 billion project to increase the Rourkela steel plant's capacity of liquid steel from 1.1 to 1.8 million tons per year. The Federal Republic of Germany may assist and fund part of the project. To date funding for the work has been meager, but SAIL scheduled completion for 1993.

The only new Government-owned integrated plant under construction in India was the Visakhapatnam steel plant (Vizag) in Andhra Pradesh. The plant has had serious delays and cost overruns—more than double the original projected cost. It was projected to begin iron production by December 1988 and steel production by 1991. The plant was expected to employ 14,000 workers when operating at its capacity of 3 million tons per year. Employment would be much lower than that at other SAIL plants, and this would help considerably in minimizing operating costs. Czechoslovakia was assisting in constructing the 850,000-ton-per-year medium merchant mill for producing small rounds, flats, and square shapes at Vizag. The Government was negotiating for the Czechoslovaks to finance the entire $154 million cost of the mill scheduled for completion in 1993.

The private sector was taking a different view of steel industry progress. Its industry representatives thought that modern technology and modest-size plants could cut production costs. Examples of this were two plants under construction at Bhandhara, near Nagpur, and Hazira in Gujarat State. The Bhandhara plant is to produce 100,000 tons per year of steel with a capital cost of $157 million. The capital cost per ton is one-half to one-third that of Government-owned integrated plants. It is a direct-reduction electric arc furnace facility using technology from the Federal Republic of Germany. It will employ only 750 workers and was scheduled to be completed in April 1988, only 25 months after construction began.

The Hazira plant, owned by the Essar Group of Gujarat, was to make sponge iron using Bombay High natural gas and iron ore pellets from the Kudremukh Mine in Karnataka. The plant would have a capacity of 880,000 tons and employ only 150 technical and 150 supporting workers. The company was to purchase an existing sponge iron facility in Europe. The cost of the plant through completion was estimated to be $235 million.

Lead and Zinc.—At yearend, Government-owned Hindustan Zinc Ltd. (HZL) was awaiting Central Government approval to construct the long-planned $475 million integrated lead-zinc mine and smelter complex in Chittorgarh District, Rajasthan. The smelter, in Chanderiya, was to have a capacity of 70,000 tons of zinc and 35,000 tons of lead per year. The mine and beneficiation plant were to be in the village of Agucha. According to the chairman of HZL, the complex could be commissioned in early 1991 if the Government granted approval by August 1988. By the seventh plan, $20 million had been provided for the project, and $124 million was to come from the United Kingdom through a grant-in-aid program. The remainder of the cost was arranged by the State Bank of India by issuing bonds. Furthermore, the project was expected to have a 28% internal rate of return and a payback period of only 4 years and 2 months. The debt-equity ratio was 35% and the foreign exchange savings during the project life of 20 years was estimated at $2 billion.

The new proposed Chanderiya smelter would increase zinc and primary lead production capacity in India to 169,000 and 65,000 tons per year, respectively, in the 1990's. Demand was projected to rise to 206,000 tons of zinc and 107,000 tons of lead by 1995 and to continue strongly upward. If the new project is implemented on time and all plants operate at capacity, there would still be a 70,000-ton deficit for each metal by the year 2000. On the other hand, if the Indian Government does not provide the funds, the metal deficit will increase while the project cost escalates. The cost to the nation in terms of metal imports and cost overruns could easily be more than the current cost of the project.[7]

HZL's production was affected by power and water problems at the Debari smelter in Rajasthan. HZL has not been able to achieve more than 84% of capacity at any time in recent years because of power problems. To solve the problems, HZL planned to install five diesel-powered generators of 5 megawatts each by April 1989.

Silver.—A one-third increase in silver production in FY 1987 was attributed to better performance of the Visakhapatnam zinc smelter and recovery of silver-copper concentrate at the Debari smelter in Rajasthan. The country's second silver-copper flotation plant was inaugurated in late 1987 at the Visakhapatnam smelter at a cost of $2.4 million. It was expected that the Visakhapatnam silver-copper flotation plant would produce about $1.7 million worth of silver concentrate per year.

Tin.—Sartin Ltd. of India plans to build a 300-ton-per-year tin smelter at Chowdwar in Madhya Pradesh. Sartin, a subsidiary of Saru Smelting Ltd. of Delhi, was set up to take advantage of State Government funding to encourage development of tin deposits. The smelter will use concentrates produced in Bastar District by Madhya Pradesh State Mining Corp. and Koraput District of Orissa. Some imported concentrates will also be used.

Base Metal Synergy Associated of the United Kingdom was to act as consultant to help with mining and processing. The Bastar District primary ore contains 0.25% tin and the primary ores near Mundaguda-frab in Koraput District range between 0.05% and 0.30% tin. The adjacent secondary alluvial deposits contain 0.9% to 2.0% tin. These primary and placer reserves were estimated to have a content of 2,000 and 2,800 tons of tin, respectively.

Titanium.—India's Defense Metallurgical Research Laboratory in Hyderabad has built an industrial-scale demonstration plant to produce titanium sponge from titanium tetrachloride. This reportedly makes India the sixth nation to produce titanium sponge. Mishra Dhatu Nigam Ltd. (Midha-

ni) in Hyderabad has been producing forged and machined titanium billets from imported titanium sponge.

The Nuclear Fuel Complex in Hyderabad has developed technology to produce consistently high-quality thin-walled, seamless titanium tubing. The plant uses a hot-extrusion process followed by cold tube-drawing to reduce the tube to the required size. This extremely expensive tubing, currently imported, is used for high temperature and corrosive applications such as power generation, chemical and oil refining, fertilizer production, and desalination.

INDUSTRIAL MINERALS

Barite.—Production continued to decline to about 212,000 tons in 1987, down from more than 580,000 tons in 1985. The decline resulted from a decrease in worldwide oil well drilling. Barite is used mainly to increase drilling-mud density in oil exploration. India also produced a small amount of snow white-grade barite for use in ceramics, paint, and paper. Indian Barytes & Chemicals Ltd. in Cuddapah District, Andhra Pradesh, has developed a red-grade barite having a specific gravity of 4.35 for high-density aggregate for undersea pipeline coating.

Cement.—The cement industry continued long-term expansion of its already large 52.7-million-ton capacity. It was estimated that 93 cement plants were operating at capacities of at least 600 tons per day each. Most of the growth has been in miniplants with capacities of 100 to 200 tons per day and from some smaller ones referred to as tiny cement plants with capacities of 20 to 100 tons per day. There were 54 miniplants in operation with a combined capacity of 2.9 million tons and about 90 miniplants in various stages of planning or construction with a capacity of 3.8 million tons per year.

Initial minimills had a maximum licensed capacity of 200 tons per day. However, in 1986 the Government increased the limit to 300 tons per day and in 1987 to 600 tons per day. Several companies were planning to take advantage of the new limit.

There were about 80 tiny cement plants in operation and an equal number in various stages of completion. Because of high transportation costs, both types use limestone from small local deposits in remote areas of the country so that they can compete with the distant rotary-kiln plants.

Construction of large rotary-kiln plants continued despite the competition from the small plants. Birla Jute & Industries, Cement Corp. of Gujarat, Dalmia Cement Ltd., Gujarat High Tech Industries, and Madras Cement Co. completed large new plants or expansions during 1987. In addition, at least six other large plants were under construction at yearend.[8]

Fertilizer Materials.—Two of the six urea fertilizer plants being built along the H-B-J natural gas pipeline were commissioned. The first to start operating was the National Fertilizer Ltd. Bijaipur plant in Madhya Pradesh. It has an ammonia capacity of 1,350 tons per day and two urea lines of 1,100 tons per day each. The second plant was owned by Indian Farmer's Fertilizer Cooperative and was at Aonla in Uttar Pradesh. Its capacity is similar to the Bijaipur plant and both use ammonia technology from Haldor Topsoe A/S of Denmark and urea technology from Snamprogetti S.p.A. of Italy. Other fertilizer plants with similar capacities along the pipeline were in various stages of planning or construction. The Jagdishpur plant was scheduled to be completed in mid-1988 and the Sawai Madhapur plant in mid-1989.

There was some question whether all of the plants would be constructed because of surplus nitrogen fertilizer in India and the high cost of production. Apparently, the question was resolved as Tata Chemical and Fertilizers Ltd. was proceeding with construction of its Babrala plant in Uttar Pradesh. Apeejay Fertilizers Ltd., not as far along, was still undecided about the choice of technology for the Shahjahanpur plant in Uttar Pradesh.[9]

Fluorite.—Gujarat Mineral Development Corp. (GMDC) announced it would expand its Kadipani flotation plant from a capacity of 20,000 to 50,000 tons per year. The plant, estimated to cost $20 million, was to be completed in 1989. Feed to the State Government-owned facility was to be supplied by the Ambadungar surface mine in Baroda District, Gujarat. The plant produced two acid-grade and one metallurgical-grade fluorite concentrates. The metallurgical-grade material is marketed in either powder or briquetted form. GMDC accounted for 90% of India's fluorite production and met about 33% of domestic demand.

Concentration tests were conducted on ore samples from the Chandidongri deposit in Rajnandgaon District, Madhya Pradesh. During the 1960's the Bhilai steel plant mined high-grade ore from the deposit and produced a 90% CaF_2-grade concentrate for its open-hearth furnace and an 82% CaF_2-

grade concentrate for use in the foundry. With the high grade ore apparently depleted, tests were being conducted to determine whether a usable concentrate could be produced from the low-grade ore by froth flotation. A concentrate ranging from 60% to 83% CaF_2 was produced. The upper limit just met the foundry-grade quality but was not sufficient for modern metallurgical use.[10]

Gem Stones.—Gems and jewelry were India's single most valuable export and as such received considerable Government attention. The value of these exports to India, however, must take into account that virtually all supplies were imported and the value added was a modest 25% to 30%. The industry was almost wholly devoted to cutting and polishing loose diamonds of less than one-tenth carat. Government and private industry were examining ways to increase the value-added differential by cutting larger stones or manufacturing diamond studded jewelry. Cutting of colored stones was being considered as well.

Except for a period in the early 1980's, cut diamond exports have increased steadily from $21 million in FY 1970 to $1.5 billion in FY 1986.

India's main source of diamond was the De Beers Consolidated Mines Ltd. marketing wing, referred to as the Central Selling Organization (CSO). CSO sells diamonds in lots, called sites, to about 300 site holders 10 times per year. The site holders' only option is to buy or reject the entire site. Approximately 44 of the site holders were Indians, who bought 32% of India's diamond this way and then sold the diamond to other traders in smaller lots. CSO also sells to site holders in Antwerp. Most of India's remaining diamond came from dealers who buy from Antwerp site holders. The prices from Antwerp were higher but the purchasers had the option to select the diamonds they wanted.

India has explored non-DeBeers African sources with limited success. The MMTC was negotiating long-term trading agreements with African countries for direct imports of rough diamond. India has bought 2% of its stones from Ghana for several years. In December 1987, MMTC concluded an agreement to buy $7 million worth of rough diamonds including high-priced diamond from Angola. Imports in recent years from all sources have been 40 million carats per year.

Indian diamond trading was centered in Bombay with most of the cutting done in nearby Gujarat State. At yearend there were 40,000 shops employing 500,000 people in the diamond cutting industry. Most of these were small operations cutting in the traditional manner, but 25 shops were using modern technology.

India specialized in cutting and polishing tiny stones called makeables. There are two classifications of stones, makeables weighing 300 to 50 pieces per carat and sawns weighing 50 pieces per carat or larger. Sawns have regular grains (crystals) and can be worked on machines. India has purchased $60 million worth of mechanized cutters, primarily, and laser equipment during the past several years.

India's main advantage, however, remained its ability to profitably cut irregularly grained makeables that cannot be cut profitably with high-tech traditional cutters. India also benefited from the increase in world supply of diamonds when Australian mines began production in 1983. Many of the diamonds from Australia were tiny stones that India cuts profitably.

The Indian Government has been looking for a way to increase taxes and value-added exports without disrupting the largely unregulated diamond cutters. One attempt was the creation of the Diamond Development Cooperative, the world's only industrial park designed expressly for diamond cutting. The park is 16 kilometers from Surat, Gujarat State, and was scheduled to open in March 1988 with 50 tenants. It was to employ 40,000 persons and have a diamond exchange, postal and customs facilities, offices for trading firms, a first class hotel, housing, a shopping center, and a hospital. The Hindustan Diamond Corp., the developer, is a joint venture of the Indian Government and a Bermuda banking affiliate of DeBeers.[11]

The Indian jewelry industry has always been huge, but it was oriented strongly to traditional gold jewelry for the domestic and Mideast markets. The principal consumers in the Mideast were Indians and other South Asians working there. The demand was for heavy 22-carat items bought more for investment value than for fashion. Gold jewelry and trade are regulated strictly by the Government. Trying to meld the gem stone trade with finished jewelry exports was a complex and controversial problem. The amount and nature of Government involvement has yet to be determined.[12]

Mica.—India was the world leader in sheet mica production and one of its major

producers in lesser grades of mica. The industry consisted of privately owned companies, except for four small mines owned by the State Government of Bihar. Crude and processed mica exports were controlled by the Mica Trading Corp. (Mitco), a Government entity formed in 1974. During the past few years, Mitco has allowed a small but increasing amount of direct shipments by private mine owners. The annual export limit for a private owner was raised to 1 million rupees ($77,000) in April 1987.

The number of operating mica mines has declined from more than 500 in 1970 to 150 in 1987. Bihar was the major producer, followed by Rajasthan and Andhra Pradesh.

Mitco has been building plants for manufacturing value-added mica products to earn more foreign exhange. Three plants were operating—a mica capacitor plant, a mica paper plant, and a micronized mica powder plant. Other projects under construction included two additional mica paper plants, each with a capacity of 300 tons per year; a 300-ton-per-year mica paper and splittings-based insulating material plant; and a 1,200-ton-per-year wet-ground mica powder plant. Mitco was also establishing a $23 million mica research and development center to be financed by the MMTC. The center will focus on developing new mica products and additional mica applications.

Statistics on the Indian mica industry were illusive and contradictory. In addition to the 150 registered mines, there were many illegal operators who evaded taxes and did not comply with regulations. Reliable statistics were particularly hard to obtain in rural Bihar State where more than one-half of the mica is mined. Production and export figures traditionally have been significantly different. In 1986, for example, the Indian Government reported the production of 7,100 tons (revised) of all forms of mica with exports listed at 22,150 tons. Because domestic consumption was not included in the above figures and mica stocks were generally insignificant, production was estimated at 25,650 tons. The Government was concerned about revenue losses from such operations. It amended the Mines and Minerals (regulation and development) Act in 1986 to increase the penalties for those convicted of mining without a license. Despite this, illegal mining continued. In 1987, the Government appointed the Controller General of the Indian Bureau of Mines to assess the problems caused by illegal mining, transportation, and the sale of various minerals, including mica.[13]

Mineral Sands.—The National Institute of Oceanography (NIO) announced the discovery of large deposits of ilmenite, conservatively estimated at 12.5 million tons, off the Konkan coast of Maharashtra. Three bays along the coast, Kalbadevi, Mirya, and Ratnagiri, have confirmed reserves of 2 million tons.[14] The deposits are mostly under the seabed and may not be profitable to mine.

The privately owned Reliance Steel Ltd. (RSL) was seeking technical assistance and equity participation by Kerr McGee Chemical Corp. (KMCC) of the United States for a $115 million titanium dioxide plant. The plant is to be in Chhatrapur, Orissa, where it would use synthetic rutile from the nearby public sector Indian Rare Earths Ltd. mineral sands separation plant. The plant would have an initial capacity of 36,000 tons per year and be completed in 1990. It would be a joint venture of RSL and State-owned Industrial Promotion and Investment Corp. of Orissa Ltd. (IPICOL). Of the $31 million equity, RSL and KMCC would hold 20% each, IPICOL would hold 11%, and the remainder would be stock sold to the general public.[15]

The Berla Group, in collaboration with Bihar State Government, has proposed a 20,000-ton-per-year, $46 million titanium dioxide plant. It would be based on the chloride process with chlorine feed supplied by the Bihar caustic soda and chemical plant, which was also a joint venture of Birla and Bihar State.

Talc.—India's Golcha Group (Associated Soapstone Distributing Co. (P) Ltd., Jaipur Mineral Development Syndicate (P) Ltd., Udaipur Mineral Development Syndicate (P) Ltd., and others) planned to increase production from 115,000 to 200,000 tons per year by 1990. Golcha produced about 90% of India's top-grade pure white talc from several mines in Rajasthan. India's talc industry employed 7,000 persons, mostly in Rajasthan.

MINERAL FUELS

Lignite.—The Federal Republic of Germany continued to provide financial and technical assistance to Neyveli Lignite Corp. Ltd. (NLC). The Federal Republic of Germany offered $115 million toward continuing long-term development of the 3-billion-ton Neyveli deposits. The Neyveli II Mine will be expanded from 4.7 to 10.7 million tons per year by 1992 and the pitside powerplant will be expanded to a

1,470-megawatt capacity. Originally the plant was to have three 210-megawatt generators, the second of which was brought on-line during the year. The Neyveli I Mine also will be expanded from 6.5 to 10.5 million tons per year. Lignite from Neyveli Mine fuels the pitside 600-megawatt powerplant, which has been Tamil Nadu's primary electricity producer.

A third-phase development of the lignite deposits and powerplants reportedly have been approved by the central Government for the 1990-95 plan and may be financed by the Soviet Union. It will be a 15-million-ton-per-year mine and pitside powerplant of 1,500 megawatts and cost $2 billion. NLC also has plans to expand out of State to develop a lignite mine and powerplant in Rajasthan.

A large lignite discovery has been made at Khandalia in the Bhavnagar District of Gujarat. Seams 4 to 13 meters thick were found at economically minable depths. Preliminary tests indicate that the quality was better than that of the Pandharo lignite mine in Kutch District.

Petroleum and Natural Gas.—India's petroleum outlook was satisfactory, particularly by developing country standards. The country, however, has been importing over one-third of its petroleum requirement and the proportion was expected to increase. Crude oil production has stagnated at about 225 million barrels annually, although demand is increasing more than 7% annually. Recent discoveries, primarily natural gas, have been small. India flared about one-third of the gas it produced.

If the trend continues, India may be producing less than 50% of the petroleum it consumes by the year 2000, contrasted with FY 1984 when it produced 80% of its needs. Although India's refineries were running at capacity, imports of refined products will inevitably rise, the amount depends on future refinery capacity. Refining capacity was 342 million barrels per year in 1987.

India's petroleum industry was owned and operated by the Government. All domestic crude oil and natural gas was produced by two Government-owned companies, Oil and Natural Gas Commission (ONGC) and OIL. This condition could change in the future because the Government signed exploration contracts with several foreign companies. In a change of policy, the Government gave wider authority to its Gas Authority of India Ltd. (GAIL) by allowing it to market all natural gas produced by ONGC and OIL. GAIL was originally established in 1984 to construct and operate the H-B-J gas pipeline network from the offshore Bombay High area to North India.

Exploration.—The Indian oil companies have been conducting a vigorous exploration program that has been somewhat successful but without a major strike like Bombay High. ONGC's FY 1987 strategy onshore was to concentrate its efforts in Rajasthan and the Himalayan foothills. Offshore, it planned to employ new directional drilling technology that enables the drill to follow the horizontal oil-producing layer. ONGC hoped to exploit deep, previously untapped reserves at the South Bassein Field. It also planned to extend offshore drilling to ocean depths beyond 200 meters. ONGC planned seismic surveys of 119,000 line-kilometers onshore and 36,000 line-kilometers offshore. The company planned 274,000 and 142,000 meters of onshore and offshore drilling, respectively, during FY 1987. It deployed 110 rigs, 54 for onshore exploration, 14 for offshore exploration, and 42 for development drilling.

The program resulted in 15 oil and gas discoveries, including gas in the Agartala Dome in Tripura; oil and gas at Kumchai, Arunachal Pradesh; and oil at Thanjavore, Tamil Nadu, Diroi and Hapjan in Assam and at Kharsing in Arunachal Pradesh. Offshore strikes included several near Bombay High and one in the Krishna-Godavari Basin south of Visakhapatnam.

ONGC planned to continue seismic surveys in FY 1988 with 65,000 line kilometers onshore and 35,000 line kilometers offshore. Exploration drilling plans for FY 1988 were 695,000 meters onshore and 337,000 meters offshore.

OIL, much smaller than ONGC, continued exploring in Assam and Arunachal Pradesh, in the Mahandi Basin in Orissa, and offshore Andaman Islands. The company also began exploring in new areas. Six wells were planned for the Jaisalmer District of Rajasthan, close to the Pakistan border. Flooding and state border disputes in the Northeast hindered some of the exploration work. During the first 8 months of FY 1987, 21 wells were completed. Of these, 10 produced oil, 2 produced gas, and the remaining wells were still being tested. All three onshore holes in the State of Orissa were dry.

In 1986, the Government, desiring to accelerate oil exploration, invited Western oil companies to help explore for offshore oil

and gas. Earlier invitations in 1980 and 1982 received little response. Terms for the 1986 leasing tender were much more favorable for the oil companies; consequently, 7 companies submitted 12 bids for 9 of the 27 offshore blocks offered. Agreements were signed for all of the blocks. The leases were awarded as follows: Four to the U.S.-based Chevron-Texaco partnership, one to Switzerland-based International Petroleum Co. of Canada, one to Australia's Broken Hill Pty. Co. Ltd. (BHP), one to Shell International Inc., and one to Amoco of the United States. The Chevron-Texaco partnership and International Petroleum have completed their seismic programs.

Under a separate 1985 agreement, the U.S.S.R. was exploring onshore structures in Northern Cambay Basin, Gujarat, and onshore and offshore in the Cauvery Basin in Tamil Nadu on a turnkey basis. The Soviets were also preparing to explore two onshore sites and one offshore site near Calcutta in West Bengal where seismic surveys, conducted jointly with ONGC, indicated favorable geologic conditions. ONGC has drilled 15 wells in West Bengal without success.

Production.—Oil or gas has been found in several areas. Three strikes were made in the Krishna-Godavari Basin, which covers 20,000 square kilometers onshore and 37,000 square kilometers offshore in Andhra Pradesh, between the rivers for which it's named. ONGC has spent more than $410 million in the area during the past 5 years. Three strikes have been made, the most favorable was offshore well GS-16 that was producing 5,000 barrels per day of oil and 5.6 million cubic feet per day of gas on an early production system. Additional development drilling was planned.

ONGC found the Gandhar Oilfield in Cambay Basin of Gujarat and the Panna Oilfield offshore, 90 kilometers northwest of Bombay. The Gandhar Field straddles the coastline 80 kilometers southwest of Baroda. Since 1984, 20 exploratory wells were drilled in the Gandhar Field. The field began production in June 1986 and was producing at more than 3,600 barrels per day at yearend 1987. Targeted production for FY 1989 was 4.6 million barrels of oil and 56 million cubic feet per day of natural gas. A pipeline spur from the Ankaleshwar-Baroda pipeline was planned.

ONGC proposed to install eight production platforms in the Panna Field. Annual production of 4.6 million barrels of oil by FY 1989 was envisioned.

Phase II production of offshore Heera Oilfield was to begin in an area 90 kilometers southwest of Uran and 70 kilometers from the South Bassein Gasfield. Seven production and support platforms were planned and 660-millimeter oil and 610-millimeter gas pipelines were to be built to the Uran oil refinery.

Pipelines.—At the end of FY 1987, India had 7,750 kilometers of pipeline transporting crude oil, natural gas, and refinery products from field to consumer. The Government planned a rapid expansion of this pipeline system. The Indian Oil Corp. was laying a 1,370-kilometer pipeline from Kandla, Gujarat, to Bhatinda, Punjab, which was scheduled for completion by 1992. It was part of the company's plan for a massive countrywide network of interconnecting pipelines. The 580-kilometer second phase of the H-B-J gas pipeline was completed to the city of Aonla in Uttar Pradesh. This section of the 1,740-kilometer line fed the Indian Farmer and Fertilizer Cooperative Ltd.'s Aonla nitrogen fertilizer plant. The first phase to Bijaipur, Madhya Pradesh, was completed in August 1987. The highest priority lines were the 300-kilometer Madras-Bangalore pipeline and a 500-kilometer Cochin-Trichy pipeline to be completed by 1990. Other lines planned were for servicing Assam, Delhi, Gujarat, and Uttar Pradesh.

ONGC proposed a national gas pipeline grid to make optimum use of India's natural gas supply, one-third of which was being flared. The plan envisioned a 11,500-kilometer distribution network to be built in three phases. Phase I was planned around proved reserves while Phases II and III were linked to potential reserves. Phase IA will extend the H-B-J pipeline 1,325 kilometers from Auriya, Uttar Pradesh, to Kapurthala, Punjab. Phase IB will be a 1,510-kilometer pipeline from Bangalore to Bombay. These segments will cost $1 billion each.

Phase II will be a 5,600-kilometer network connecting the Phase I grid to Trivandrum, Kerala. Phase III envisions 3,250 kilometers of pipeline linking gas deposits in Northeast and East India to the national grid. The advantages of the proposed pipeline grids are obvious considering that 160 million barrels of crude oil and refinery products were moved in 1987 by rail—a slow, inefficient, and expensive method.

Refineries.—A shortage of refining capacity has developed gradually. India's capacity was 342 million barrels per year at the

end of FY 1987, with another 132 million barrels likely to be added by FY 1994. The increase will be provided by a 44-million-barrel-per-year plant in Baholi, 40 kilometers southwest of Karnal, Haryana; a 22-million-barrel-per-year refinery in Mangalore, Karnataka; a 14.7-million-barrel-per-year refinery in Asam; and the expansion of several refineries.

Construction of the Tata-Indian Oil Refineries Ltd. (TIORL) refinery in Karnal was scheduled to begin in late 1988. The cost was estimated to exceed $1 billion. Tata Chemical and Fertilizers, the copromotor of the project, and Indian Oil Co. will each have 26% equity with the balance held by the public. The debt-equity ratio was to be 4:1. The Soviets have pledged to provide credit and equipment for the project.

In June, the Government's Hindustan Petroleum Corp. Ltd. (HPCL) and Birla's Indian Rayon and Industries Ltd. (IRIL) signed an agreement to construct a 22-million-barrel-per-year refinery at Mangalore, Karnataka. As with TIORL, HPCL and IRIL will hold 26% equity with the balance being held by the public.

Refineries slated for expansion include Koyali in Gujarat; Mathura in Uttar Pradesh; Bombay, owned by HPCL; and Kerala, owned by Cochin Refineries Ltd.

The Government announced that it will build five more 44-million-barrel-per-year-capacity refineries during the next decade. If India expects to meet the projected long-term demand of 770 million barrels per year, it must increase capacity by an additional 293 million barrels per year. But, until then, India will need to import more refined products and crude oil.[16]

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[1]Physical scientist, Division of International Minerals.
[2]Where necessary, values have been converted from Indian rupees (Rs) to U.S. dollars at the rate of Rs13.00=US$1.00.
[3]The Indian fiscal year begins on Apr. 1 of the year stated.
[4]Mining Journal (London). V. 309, No. 7927, July 27, 1987. p. 62.
[5]Government of India, Indian Bureau of Mines. Indian Minerals Yearbook, 1986. Trade (Preprint). Pp. 819, 876.
[6]U.S. Consulate, Calcutta, India. Calcutta Airgram A-09, Oct. 5, 1987, p. 7.
[7]U.S. Embassy, New Delhi, India. State Dep. Telegram 17956, R191155Z, July 1988.
[8]Rock Products. V. 91, No. 4. Apr. 1988, p. 63.
[9]Nitrogen. No. 172. Mar.-Apr. 1988, p. 8.
[10]Indian Mining and Engineering Journal. V. 26, No. 5, May 1987, p. 23.
[11]Far Eastern Economic Review. V. 139, No. 7, Feb. 18, 1988, p. 64.
[12]U.S. Embassy, New Delhi, India. State Dep. Telegram 18002, R200454Z, July 1988.
[13]———. India's Mica Industry—Problems and Prospects. State Dep. Telegram 13625, R271326Z, May 1988.
[14]Indian Mining and Engineering Journal. V. 26, No. 11. Nov. 1987, p. 25.
[15]U.S. Embassy, New Delhi, India. State Dep. Telegram 30260, P162228Z, Dec. 1987, p. 2.
[16]———. State Dep. Telegram 19075, R020721Z, Aug. 1988.

The Mineral Industry of Indonesia

By John C. Wu[1]

Indonesia was the world's largest producer and exporter of liquefied natural gas (LNG), the 3d largest producer of tin, the 4th largest producer of nickel, and the 13th largest producer of crude oil in 1987. Indonesia remained a significant producer of primary aluminum, bauxite, cement, coal, copper concentrate, iodine, and nitrogen fertilizer material in the Far East.

The mineral industry remained a significant sector of the Indonesian economy. The industry continued to contribute about 20% to Indonesia's gross domestic product (GDP) and its exports accounted for 60% of Indonesia's export earnings in 1987. The oil and gas industry, the major player in the mineral industry of Indonesia, recovered slightly from the sharp drop in world oil prices in 1986. The tin industry, the second most important player, also recovered slightly from the drastic decline in tin prices following the October 1985 tin crisis.

The output of crude oil, excluding condensate, was lower than that of 1986 because of the reimposition of production quotas by the Organization of Petroleum Exporting Countries (OPEC) to stabilize world oil prices. But the combined output of crude oil and condensate rose slightly to an average of 1.4 million barrels per day. The output of natural gas broke the previous record high of 1.7 trillion cubic feet owing to increased domestic consumption by LNG plants for new exports to the Republic of Korea.

Coal production also reached a new record high as the output of coal from the Bukit Asam Mine in South Sumatra increased to 1.4 million tons from 1 million tons in 1986. Construction of the Tarahan coal terminal was taken over by a Dutch concern from the British-Canadian consortium and was expected to be completed by 1989. Despite an increase in 1987 coal production, Indonesia continued to import 400,000 tons of coal from Australia to meet requirements for the Suralaya thermal powerplant in West Java.

Oil and gas exploration slowed substantially because of uncertainty in the world oil market and continued weakness in world demand for oil. The number of exploratory wells dropped sharply to 82 from 156 in 1986 and 254 in 1985. However, seven oil and gas exploration and development contracts were signed with major foreign oil companies from Canada, the Netherlands, the United Kingdom, and the United States. Exploration of coal in Kalimantan and Sumatra continued. Two major foreign contractors, having a production-sharing contract with the state coal mining company, planned to start production in 1988 or 1989.

The output of most minerals and metals, except bauxite, increased in 1987 because of higher prices in the world market. Copper production at the Ertsberg Mine in Irian Jaya by Freeport Indonesia Inc. (FI) of the United States, under a first generation contract of work, broke a previous record high. As a result of extensive drilling in the Ertsberg mining area, FI increased its estimated proven and probable ore reserves of copper to 99.6 million tons averaging 1.7% copper from 62.8 million tons averaging 2.3% copper.

The combined gold production from the Ertsberg Mine, P.T. Aneka Tambang's (P.T. Antam) Cikoto Mine in South Banten, and two foreign contractors' mines in Bengkulu, South Sumatra, and Cempaka Buang Kasongan, Central Kalimantan, also broke a previous record high. Because of increased gold prices during the past 2 years, unprecedented growth in gold mining by so-called

people's miners and small-scale illegal miners, mostly operating in Kalimantan and Sumatra, was reported. The Government planned to stop all illegal gold mining in 1988. In 1987, the Government of Indonesia awarded 60 more Contracts of Work to foreign companies bringing the total to 103 for gold exploration and development in Indonesia. The promotion of increased gold production and exports was part of the Government's strategy to improve export earnings of nonoil commodities.

Combined nickel production by P.T. Antam in the Pomalaa area and on Gebe Island, and P.T. International Nickel Indonesia (P.T. Inco) in the Soroako area reached a new record high. Because of higher nickel prices and an effective cost-reduction program. P.T. Inco, for the first time since it began commercial operations in 1979, reported a net income in 1987. The tin industry continued to implement the Government policy to reduce costs by increasing mine output. As a result, tin production increased 2,100 tons over that of 1986. The higher production was mostly by P.T. Tambang Timah (P.T. Timah), the state-owned tin mining company, from its onshore and offshore operations of Bangka Island. The company reported that its production cost was reduced to $2.59[2] per pound from $2.72 per pound in 1986.

The expansion in cement capacity has been postponed until 1990 because of excess capacity and weak demand in the Far East. The industry continued to implement its coal conversion program to save oil and gas for export. However, the nitrogen fertilizer industry continued its expansion program. Construction of the third urea plant by P.T. Pupuk Kalimantan Timur in Bongtang, East Kalimantan, was on schedule for completion in July 1988. By 1989, the annual urea capacity should be raised to 5.0 million tons from 4.5 million tons.

In the metallic mineral processing sector, production of primary aluminum by P.T. Indonesia Asahan Aluminum (IN-ALUM) in North Sumatra decreased slightly due to power shortages caused by lower water levels for the smelter's hydroelectric powerplant at Lake Toba. Production of nickel sulfate matte by P.T. Inco at Soroako, South Sulawesi, was below the 1987 target resulting from the temporary closure of a smelter for modernization. Production of steel by P.T. Krakatau Steel in Cilegon, Java, increased slightly owing to stronger domestic and overseas demand for its products. The company planned a $400 million modernization and expansion program during the next 5 years. Production of refined tin by P.T. Timah at Mentok, Bangka Island, increased only slightly because of a tin-export quota of 24,516 tons for Indonesia imposed in March by the Association of Tin Producing Countries.

Contracts for two liquefied petroleum gas (LPG) plants were awarded to two Japanese companies in February. A 1.6-million-ton-per-year LPG plant will be built at Arun in North Sumatra and a 350,000-ton-per-year LPG plant will be built in Bontang, East Kalimantan, at a cost of $879 million. Both plants were scheduled to come on-stream in 1988. A contract for a 1.5-million-ton-per-year LNG plant at Badak near Bontang, East Kalimantan, was expected to be awarded by the Government in early 1988.

The Indonesian economy, as measured by the real GDP, grew 3.5% compared with 3.2% (revised) in 1986.[3] The growth was attributed to higher export prices for oil and gas. However, impressive gains in export earnings of nonoil commodities also contributed to the growth in the Indonesian economy. Indonesia's GDP in 1983 constant dollars was estimated at $52,050 million in 1987 compared with $50,290 million in 1986. The inflation rate, as measured by the Consumer Price Index, was down slightly to 8.0% from 9.2% in 1986.[4]

Because of increased export earnings from oil and gas as well as other commodities, Indonesia's merchandise trade balance improved considerably. In 1987, export earnings of oil and gas in the form of LNG were $8.7 billion, while export earnings of nonfuel minerals and metals were estimated at $980 million.

PRODUCTION

Because of the improved world market, most minerals and metals production in Indonesia increased in 1987. The mineral fuels sector continued to dominate Indonesia's mineral industry. Production of crude oil, excluding condensate, was down slightly because of reduced quotas imposed by OPEC. Production of natural gas reached another record-high level resulting from increased consumption by the LNG plants

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS					
Aluminum:					
Bauxite, gross weight ----- thousand tons	778	1,003	830	650	635
Metal, primary ----------	114,766	198,960	216,820	218,772	201,402
Copper, mine output, Cu content ----------	[r]78,589	[r]82,503	[r]88,742	95,781	102,058
Gold, mine output, Au content[2] --- troy ounces	76,888	78,677	[r]84,203	106,226	114,746
Iron and steel:					
Iron sand, dry basis ----------	132,887	82,997	130,930	153,271	193,986
Metal:					
Ferroalloys, ferronickel ----------	20,708	22,774	23,789	22,554	15,175
Steel, crude ----------	800,000	1,000,000	1,200,000	1,500,000	1,453,000
Manganese ore ----------	8,318	12,267	33,295	1,424	1,196
Nickel:					
Mine output, Ni content[3] ----------	49,378	47,604	40,336	52,679	57,788
Metallurgical products:					
Matte: Ni content ----------	18,288	22,815	24,946	27,975	26,532
Ferronickel: Ni content ----------	4,855	4,826	4,802	4,548	3,060
Silver, mine output, Ag content thousand troy ounces	1,135	1,121	[r]1,228	1,498	1,530
Tin:					
Mine output, Sn content ----------	26,554	23,223	21,759	24,049	26,183
Metal ----------	28,390	22,467	20,909	22,080	24,200
INDUSTRIAL MINERALS					
Asbestos[e] ----------	25,000	25,000	25,000	25,000	25,000
Cement, hydraulic ---------- thousand tons	8,187	8,907	10,081	10,941	11,837
Clays:					
Bentonite ----------	10,006	12,505	6,659	[e]10,000	7,762
Kaolin powder ----------	59,628	83,414	106,869	124,937	113,836
Diamond:[e]					
Industrial stones ------- thousand carats	22	22	22	22	22
Gem ---------- do	5	5	5	6	7
Total ---------- do	27	27	27	28	29
Iodine ---------- kilograms	25,297	24,970	13,416	5,790	8,227
Nitrogen: N content of ammonia ----------	1,150,400	1,658,200	[r]2,057,300	2,298,500	2,363,900
Phosphate rock ----------	5,573	1,917	525	601	2,592
Salt, all types ---------- thousand tons	618	370	[e]600	[e]600	[e]600
Stone:					
Granite ---------- do	2,405	1,583	1,421	1,240	1,181
Limestone[4] ---------- do	12,073	11,314	11,770	12,784	15,571
Marble ---------- square meters	24,374	16,108	9,699	3,530	8,134
Quartz ----------	372,216	541,827	682,125	[e]650,000	[e]670,000
Sulfur, elemental[5] ----------	2,769	4,999	4,023	[e]4,000	[e]5,000
MINERAL FUELS AND RELATED MATERIALS					
Asphalt rock, natural ----------	533,188	471,239	450,633	242,055	84,889
Coal ---------- thousand tons	648	1,468	1,942	2,601	2,834
Gas, natural:					
Gross ---------- million cubic feet	1,186,362	1,521,450	1,580,012	1,628,920	1,732,052
Marketed ---------- do	1,032,321	1,386,051	1,148,628	1,113,286	1,188,358
Petroleum:					
Crude including field condensate thousand 42-gallon barrels	490,483	516,990	483,768	507,241	509,029
Refinery products:					
Gasoline ---------- do	12,980	21,879	23,619	28,119	[2]29,000
Jet fuel ---------- do	2,760	4,923	3,845	1,631	[3]3,000
Kerosene ---------- do	31,669	39,141	38,383	43,043	[e]45,000
Distillate fuel oil ---------- do	37,522	43,935	50,060	73,490	[e]74,000
Residual fuel oil ---------- do	66,596	67,160	19,006	30,221	[e]30,000
Lubricants ---------- do	487	93	1,263	1,574	[e]1,600
Liquefied petroleum gas ---------- do	471	674	2,101	2,787	[3]3,000
Paraffin wax ---------- do	76	32	79	116	[e]100
Naphtha ---------- do	19,074	14,736	17,148	17,306	[e]17,200
Unfinished oils requiring further processing ---------- do	2,405	1,032	25,710	22,621	[e]23,000
Unspecified ---------- do	5,657	3,678	24,150	2,533	[e]3,000
Refinery fuel and losses ---------- do	5,169	2,251	8,527	10,004	[e]11,000
Total ---------- do	184,866	199,534	213,891	233,445	[e]239,900

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

[1]Table includes data available through Aug. 2, 1988.

[2]Includes Au content of copper ore and output by Government-controlled foreign contractors' operations. Gold output by operators of so-called people's mines and illegal small-scale mines is not available but may be as much as 15 tons per year.

[3]Includes a small amount of cobalt that 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.

for new exports to the Republic of Korea. Production of coal also reached record-high level owing to increased output from the Bukit Asam Mine and other smaller coal mines operating in South Sumatra and East Kalimantan, despite a considerable decline in coal production from the Ombilin Mine.

In the metallic minerals sector, production of bauxite decreased slightly owing to reduced overseas demand, especially from Japan. Production of copper, gold, nickel, and silver all broke previous record highs in 1987. Copper, gold, and silver produced by FI continued the 1986 upward trend resulting from improved market conditions and the company's successful cost-containment program. Unrecorded gold production by the people's mines and other small-scale illegal miners operating in Kalimantan and Sumatra was estimated to be as large as 15 tons for each of the past 2 years. Production of nickel ore by P.T. Antam rose substantially resulting from a stronger demand from Japan. Production of tin also increased considerably because of the Government's policy to reduce production costs by increased output from higher ore-grade tin mines.

In the industrial minerals sector, production of limestone moved higher because of increased domestic consumption by the cement industry. Production of kaolin was also at a higher level than that of 1986 due to increased domestic demand by the ceramic, paper, and cosmetic industries and more exports to Japan. Exploration for diamonds by a foreign contractor in southeastern Kalimantan indicated the possibility of dredging diamond-bearing gravel within 2 years.

In the mineral processing sector, production of LNG and urea both broke previous highs in 1987, resulting from expanded capacities and increased exports. Production of cement also reached a record-high level because of stronger demand by the construction sector. Production of primary aluminum by IN-ALUM in North Sumatra was down because of an electrical power shortage in the fall. Production of ferronickel by P.T. Antam and nickel matte by P.T. Inco was at a lower level than that of 1986 because of equipment failure and a temporary plant shutdown for modernization.

TRADE

The merchandise trade balance improved substantially resulting from a considerable increase in export earnings from crude oil and nonfuel commodities and a slight increase in imports. Export earnings from crude oil and refined petroleum products rose to $6.1 billion from $5.4 billion in 1986, reflecting increased world oil prices. Export earnings from LNG declined to $2.6 billion from $2.8 billion in 1986, owing to rebates to Japanese importers for overcharges in 1986. Export earnings from nonfuel commodities reached a record-high level reflecting continued strong support by the government to promote exports of so-called nonoil commodities.

Export earnings of nonoil commodities exceeded those of oil and gas beginning in August, as they averaged more than $800 million per month compared with $728 million per month for oil and gas. The substantial gain in earnings from exports of nonoil commodities was due to increased world market prices for commodities such as coffee, copper, gold, nickel, palm oil, plywood, rubber, timber, and tin. The estimated value of major mineral exports in 1987 were copper concentrate, $190 million; primary aluminum, $180 million; gold, $176 million; refined tin, $144 million; steel products, $130 million; nickel matte, $120 million; ferronickel, $15 million; and bauxite, $8 million.

Imports of merchandise rose slightly to $11.2 billion because of more imports of chemicals, machinery, and electrical equipment. However, imports of transport equipment, consumer durables, and paper products were lower than in 1986. Imports of crude petroleum for domestic refineries and other mineral fuels increased slightly to $2.3 billion from $2.2 billion in 1986 resulting from higher prices of crude oil and coal.

Based on the value of two-way trade, Japan, the United States, Singapore, and the European Economic Community (EEC) countries remained the major trading partners of Indonesia. In mineral trade, based on value, crude oil went mainly to Japan, the United States, and the Republic of Korea; LNG to Japan and the Republic of Korea; aluminum, bauxite, copper, gold, and nickel mainly to Japan; tin to Japan, the United States, and many EEC countries; cement to Bangladesh; and coal to Japan and many Asian countries. The EEC countries, Japan, and the United States remained the principal suppliers of Indonesia's capital goods, chemicals, machinery, and electrical equipment in 1987.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—Bauxite production by P.T. Antam from Bintan Island and three nearby small islands decreased slightly from that of 1986 despite a new sales contract signed in late 1986 for exports to the Republic of Korea. Exports of bauxite to Japan dropped to 531,000 tons from 597,000 tons in 1986 and from 992,000 tons in 1984. As a result of reduced demand by Japan, P.T. Antam reportedly planned to export an additional 200,000 tons to Middle East countries, 100,000 tons to the United States, and 50,000 tons to the Republic of Korea in 1988.

To revive the plan to construct a 600,000-ton-per-year alumina plant on Bintan Island, the Government of Indonesia formed a team through the Technology Research and Application Board to restudy the project and was seeking $500 million of capital funding from foreign investors as partners in the project. The bauxite reserves on Bintan Island for the alumina plant were estimated at 75 million tons averaging 49.4% Al_2O_3 and 8.2% SiO_2.

Production of primary aluminum by IN-ALUM at Kuala Tanjung in North Sumatra was about 8% lower than that of 1986. The production cutback during the third quarter resulted from a low level of water at Lake Toba where the smelter's hydroelectric powerplant is based. The smelter reportedly resumed near-capacity production by year-end. Exports of primary aluminum, mostly to Japan, reportedly dropped to 146,000 tons from 180,000 tons in 1986.

In June, an agreement was finally reached between the Governments of Indonesia and Japan to rescue IN-ALUM from financial difficulties. The problems were caused by increased payments of interest and principal resulting from the appreciation of the Japanese yen and decreased revenues resulting from low U.S. dollar-based world market prices of aluminum. Under the agreement, the Japanese partners were to invest an additional $172 million and the Government of Indonesia was to invest $58 million. The new capital reportedly would be used for debt service. To reduce the heavy debt burden of IN-ALUM, the Government of Indonesia also agreed to convert its $231 million loan to IN-ALUM into equity capital while the Export-Import Bank of Japan, the major creditor, was expected to cut its interest rates on loans to IN-ALUM from 7% to 8% to 5%.[5]

Copper.—Production of copper in concentrate by FI at the Ertsberg (Gunung Bijih) Mine in Irian Jaya reached 102,000 tons in 1987, a record-high level since the mine started commercial operation in 1972. According to the company's 1987 annual report, production costs were reduced further (including depreciation and gold and silver credits) to $0.48 per pound of copper. Because of record production and its cost-containment program, FI ranked among the lowest cost copper producers in the world. Ore processing averaged 16,371 tons per day compared with 15,124 tons per day in 1986. The amount of copper, gold, and silver contained in 259,000 tons of concentrate produced in 1987 was 102,058 tons, 92,000 troy ounces, and 1,344,000 troy ounces, respectively. Despite a slight decrease in exports, revenues rose to $190 million compared with $151 million in 1986 owing to increased market prices for copper, gold, and silver.

According to the company's 1987 annual report, the average market price of copper, gold, and silver was $0.85 per pound, $441.73 per troy ounce, and $6.74 per troy ounce, respectively, compared with $0.62 per pound, $359.00 per troy ounce, and $5.42 per troy ounce, respectively, in 1986. Owing to a 26% increase in revenues and a further reduction in production cost, FI's net income rose sharply to $50.8 million from $19.5 million in 1986.

As a result of extensive definition drilling of two new ore bodies by FI in its mining contract area, a significant quantity of ore reserves was ascertained and added to FI's reserve base in 1987. The estimated proven and probable ore reserves in the Ertsberg mining area at yearend 1987, including the Ertsberg and Ertsberg East ore bodies plus the new ones (the Deep Ore Zone under Ertsberg East and the DOM ore body, 800 meters to the south of Ertsberg East) were 99.6 million tons containing 1.7% copper.[6]

Gold.—After the Government lifted the gold export ban in the fall of 1986 and because of the high world market price of gold, Indonesia experienced a gold mining miniboom in 1987. More than 115,000 troy ounces of gold was produced in 1987, breaking the record-high level of 1986. Addi-

tionally, according to estimates by some observers in Indonesia, unrecorded gold production from traditional people's and illegal mining operations in Sumatra and Kalimantan was between 10 and 13 tons per year during the past several years.

Of the official gold total, 92,000 troy ounces was produced by FI at the Ertsberg copper mine, 18,000 troy ounces by P.T. Lusang Mining from the Lebong Tandai gold-silver mine in Bengkulu, South Sumatra, and 5,000 troy ounces by P.T. Antam from the Cikotok gold-silver mine in South Banten, West Java. However, according to an estimate by the Department of Mines and Energy, 100,000 miners were illegally searching for and mining gold in Bali, Java, Kalimantan, and Sumatra. Gold production by these miners, mostly panned gold from rivers and streams, has never been recorded. From October 1986 to September 1987, official exports of gold totaled 9.1 tons valued at $121.5 million.

The illegal miners occasionally caused problems for foreign contractors and traditional people's miners by overrunning their sites when word of a gold strike was heard. To protect the traditional miners and foreign contractors, the Department of Mines and Energy planned to issue instructions to the provincial Governors and local military officials to eliminate illegal gold mining activities in 1988.

During 1987, two contractors started gold operations in Kalimantan. P.T. Ampalit Mas Perdana, a joint venture of Pelsart Resources N.L. (42.5%) and Jason Mining Ltd. (42.5%) of Australia, and P.T. Yanawati Perdana (15%) of Indonesia, started mine development at Cempaka Buang Kasongan in Central Kalimantan. Two bucketwheel suction dredges ordered from Neumann Equipment Pty. Ltd. of Australia were scheduled to arrive at the mine by November for stripping overburden and delivering the ore to the spiral floating treatment plant. Gold production was scheduled to begin in 1988 at an initial rate of 16,000 troy ounces per year. P.T. Monterado Mas Mining, a joint venture of BP Minerals International Ltd. of the United Kingdom (65%), the International Finance Corp. (20%), and P.T. Prima Searco (15%) of Indonesia, also started mine construction at Monterado in the Sambas region of West Kalimantan. P.T. Monterado Mas reportedly also ordered two Neumann bucketwheel dredges for stripping and mining, and awarded Mineral Deposits Ltd. of Australia a contract to build two alluvial gold plants and a concentrate upgrading plant for the Monterado Mine. Commercial gold production was scheduled to begin in late 1988 at an initial rate of 16,000 troy ounces per year.

In line with the Government policy to increase nonoil commodity exports, Indonesia continued to promote gold exploration in 1987. In addition to 9 Contracts of Work (COW) awarded in 1985 and 34 in 1986, 60 were awarded in 1987 bringing the total to 103 concessions covering more than 35.5 million hectares. Most contract areas, however, were concentrated in the following Provinces: East, Central, West, and South Kalimantan, North Sulawesi, and Jambi and Bengkulu in Sumatra. There were 51 prime foreign contractors for the COW, of which 33 were from Australia, 6 from Hong Kong, 5 from Singapore, 3 from the United Kingdom, 3 from the United States, and 1 from Malaysia. The three U.S. companies were Newmont Mining Corp. with three contracts and Pennzoil Co. (through Duval Corp. of Indonesia) and Battle Mountain Gold Co. with two contracts each.[7]

During 1986-87, a significant number of substantial gold anomalies in West Kalimantan were identified by Dominion Gold Mines Ltd. (DGM) of Hong Kong, a subsidiary of Dominion Mining Ltd. of Australia. In October, DGM, under a joint-venture agreement with P.T. Antam (17.5%) was awarded three contracts by the Government of Indonesia covering 7,437 square kilometers in West Kalimantan. P.T. Antamdomin Bengkayang was established for one of the contract areas to undertake followup work on anomalies in the Bengkayang area of West Kalimantan.

In anticipation of an increase in gold production, P.T. Antam was expanding the capacity of its Logam Mulia precious metals refinery in Pulo Gadung from 13 to 24 tons per year, which was expected to be completed in the spring of 1988. The precious metals produced at the refinery included gold, platinum, and silver.

Iron and Steel.—Iron sands produced by P.T. Antam from the southern coastal area of Central Java rose substantially because of increased domestic demand and exports. Production of sponge iron and steel by Krakatau Steel from its integrated complex at Cilegon, 120 kilometers west of Jakarta, also increased considerably owing to strong overseas demand for its products. Because of a substantial increase in exports, mostly to Japan and the United States, Krakatau

Steel's export earnings rose to $130 million from $56 million in 1986.

To increase production and improve quality and efficiency, Krakatau Steel planned to launch a 5-year $400 million modernization and expansion program in 1988. The 5-year program included upgrading the company's direct-reduction plant by converting the existing HYL I fixed-bed process to an HYL III continuous process; doubling the plant's capacity to 4 million tons per year; expanding the capacity of billet and slab production from 1.5 to 2.5 million tons per year; and increasing the capacity of the hot-strip and wire-rod mills from 1.1 million to 1.8 million tons per year and from 200,000 to 250,000 tons per year, respectively.[8]

Nickel.—Because of a significant improvement in the world nickel market in the last half of 1987, production of nickel ore rose sharply. Production by P.T. Antam from the Pomalaa area in southeastern Sulawesi and on Gebe Island in the North Moluccas reached 1.9 million tons of which 76% was produced from Gebe Island. Exports of nickel ore to Japan declined slightly to 1.3 million tons from 1.4 million tons in 1986.

Ferronickel produced by P.T. Antam from its 4,800-ton-per-year smelter at Pomalaa decreased to 3,060 tons of contained nickel resulting from a temporary shutdown because of heavy damage to an old furnace. The plant was overhauled with imported equipment to increase productivity and efficiency. Exports of ferronickel, mostly to Japan and India, remained at 4,100 tons of contained nickel in 1987.

P.T. Inco, an integrated nickel operator in the Soroako area of South Sulawesi, produced 26,532 tons of nickel in nickel-sulfate matte compared with 27,975 tons (revised) in 1986. A higher production target of 29,500 tons was planned for 1988 because of expected strong demand from Japan and the anticipated tightening of the world nickel supply in 1988. Exports of nickel-sulfate matte to Japan rose to 29,603 tons from 28,656 tons in 1986.

As a result of a successful cost-reduction program, the higher market price of nickel, and increased sales to Japan, the company reported operating earnings of $15 million and a net income of $500,000 in 1987 for the first time since it started commercial operation in 1979.

According to P.T. Inco's annual report, the cost of its nickel production was reduced by 50% between 1982 and 1987. Of this reduction, 20 percentage points were achieved in 1987 through technological improvements, energy cost and employment reductions, and a steady increase in production. At yearend, proven and probable nickel ore reserves in the Soroako contract area were 76.2 million tons containing 1.5 million tons of nickel.

Tin.—Despite only a moderate improvement in the world tin market, Indonesia's tin production continued upward. However, the 1987 output was 1,000 tons less than the Government-targeted production of 27,216 tons. Cost reduction through increased production continued to be the Government policy for the tin mining industry in 1987. Under an agreement reached by the seven-member Association of Tin Producing Countries (including Indonesia) in early 1987, Indonesia's tin exports were limited to 24,516 tons in 1987.

P.T. Timah, the state-owned company, continued to dominate the tin mining industry producing 21,636 tons of tin in concentrate, which accounted for 83% of the total production. P.T. Koba Tin, a joint-venture company of P.T. Timah (25%) and C.S.R. Ltd. (36.5%) and Boral Ltd. (36.5%) of Australia, produced 4,042 tons and accounted for 15% of total production. P.T. Preussage Kelapa Kampit, which took over underground tin mining operations on Belitung Island from P.T. Broken Hill Pty. in 1985, produced 519 tons and accounted for 2% of total production.

During the past, the dredging sector played a significant role in helping the tin mining industry reduce tin production costs by increasing productivity in Indonesia. In 1987, 28 of 33 dredges, including three large offshore dredges—Belitung I, Bangka II, and Singkep I—reportedly were operating onshore and offshore around the islands of Bangka, Belitung, Singkep, Kundur, and Karium off the southeastern coast of Sumatra. According to P.T. Timah, its production by dredging rose to 58% in 1987 from 47% in 1980. Of the company's 12,550 tons of tin produced by dredges, 81% was offshore and 19% onshore.

Production of refined tin by P.T. Timah's smelter, Peleburan Timah (Peltim), at Mentok on Bangka Island increased to 23,800 tons from 22,080 tons in 1986. Peltim produced two brands of tin metal (Mentok and Bangka) in 35-kilogram ingots, 17.5-kilogram ingots, tin anode, and tin shot for domestic and export markets. Mentok tin,

with a minimum of 99.85% tin, was produced for domestic and overseas markets. Bangka tin with a minimum of 99.935% tin and a maximum of 0.014% arsenic, 0.014% lead, and 0.001% bismuth, was marketed directly to domestic and overseas consumers and could not be resold or reexported. According to the Department of Mines and Energy, exports of refined tin declined to 22,195 tons from 23,300 tons in 1986, but export earnings of tin rose slightly to $144 million from $140 million (revised) in 1986 owing to a slight increase in price. However, because of a weak domestic market, domestic consumption of tin dropped sharply to 880 tons from 1,166 tons in 1986. As a result of increased export earnings and a further reduction in production cost to $2.59 per pound from $2.72 in 1986, P.T Timah reportedly made a net profit of $ 3 million in 1987.[9]

P.T. Koba reportedly acquired a used dredge from Selangor Dredging Bhd. of Kuala Langat, Malaysia, and awarded a $12 million contract to Osborne Chappel Payne Ltd. of the United Kingdom in November to provide design engineering and project management services for transferring the dredge from Kuala Langat to its contract area in Southeast Bangka Island. The dredge, with 139 buckets and capable of digging to a maximum depth of 40 meters, has a 5.4-million-cubic-meter capacity. P.T. Koba planned to deploy the dredge in late 1988.

According to the Department of Mines and Energy, Indonesia has proven and probable tin ore reserves of 1.64 million tons of which 740,000 tons were proven. About 1.28 million tons of these reserves were on Bangka Island and 705,000 tons of these reserves were offshore.

INDUSTRIAL MINERALS

Cement.—Cement production continued to increase as domestic sales and exports rose moderately to 10 million tons and 2 million tons, respectively, in 1987. According to the Indonesia Cement Association, annual capacity would remain at 17.4 million tons until 1990 because of excess capacity and keen competition in the Far East and Southeast Asia markets. In 1987, about 1 million tons of cement was exported to Bangladesh, while about 276,000 tons of cement clinker was exported to Singapore.

The cement industry continued its coal conversion program. In 1987, P.T. Semen Andalas Indonesia reportedly completed conversion of its oil-fired grinding plant at Lhok'nga, 16 kilometers south of Banda Aceh in North Sumatra, to pulverized coal.[10] Coal consumed by the plant was supplied from the Ombilin Mine in West Sumatra.

Diamond.—Acorn Diamond Indonesia Pty. Ltd. (ADI), a subsidiary of Australia's Acorn Securities Ltd., upgraded the reserves of its Danau Seran alluvial diamond property in southeastern Kalimantan to 29 million to 34 million cubic meters of diamondiferous gravel and has proven 2 million cubic meters by detailed dredge path design drilling. According to ADI, a bulk sample of 5,085 cubic meters yields an average grade of 0.2 carat per cubic meter.

ADI reportedly was investigating the use of idle tin dredges in Malaysia for mining the diamond bearing gravels. According to preliminary estimates, at a cost of $15 million for reconditioning a dredge and production of 203,000 carats at a stripping ratio of 4.3 to 1 for 1 million cubic meters of gravel, the production cost would be $45 per carat or $9 per cubic meter. The diamond-bearing gravel in the Danau Seran area reportedly also contains gold and platinum having an estimated value of $35.50 per cubic meter.[11]

Fertilizer Materials.—Indonesia's fertilizer industry continued to expand with Government support under the fourth 5-year development plan (1985-89). In the nitrogen sector, the annual urea capacity of five producers was expanded from 3.3 million tons in 1984 to 4.5 million tons in 1985. The capacities of the five operating urea producers in 1987 were P.T. Pupuk Sriwijaya, 1,620,000 tons with four plants in Palembang, South Sumatra; P.T. Pupuk Kalimantan Timur (Kaltim), 1,140,000 tons with two plants in Bontang, East Kalimantan; P.T. Asean-Aceh Fertilizer, 570,000 tons, and P.T. Pupuk Iskandar Muda, 570,000 tons, both plants at Lhokseumawe in Aceh, northeastern Sumatra; and P.T. Pupuk Kujan, 570,000 tons in Tjikampek, West Java. In 1987, most urea producers were operating near capacity. Construction of Kaltim's third 570,000-ton-per-year plant in Bontang, East Kalimantan, reportedly was on schedule for completion in mid-1988 and commercial production in early 1989.

In the compound fertilizer sector, P.T. Petrokimia Gresik, which underwent several phases of expansion, operated a large compound fertilizer complex in Gresik, East Java. The company has an annual capacity

of 1 million tons of triple superphosphate and 650,000 tons of ammonium sulfate fertilizer. It produced 1.5 million tons of compound fertilizer in 1987.

MINERAL FUELS

Coal.—Coal production continued its upward trend and reached another record-high level in 1987. Increased output from the Bukit Asam Mine in South Sumatra and several private coal companies in East Kalimantan and in the Bengkulu area of South Sumatra contributed most to the increase.

Coal produced by state-owned Perusahaan Umum Tambang Batubara (P.N. Batubara) at the Ombilin Mine in West Sumatra declined from 710,000 tons in 1986 to 506,000 tons because of equipment failures and other problems caused by prolonged heavy rain. Coal produced by state-owned P.T. Tambang Batubara Bukit Asam at the Bukit Asam Mine in South Sumatra rose from 1.0 million tons in 1986 to 1.4 million tons, of which 78% came from the Muara Tiga deposit and the remainder from the Air Laya deposit where mining was started in April. Construction of the Tarahan coal terminal at the southern tip of Sumatra, part of the Bukit Asam expansion, was taken over by Balast Nedam BV of the Netherlands from a British-Canadian consortium and was expected to be completed by 1989.

Coal production by six private coal companies including C.V. Fadjar Bumi, C.V. Baiduri Enterprise, P.T. Kitadin Corp., P.T. Tanito Harum in East Kalimantan, and P.T. Bukit Sunur and P.T. Danau Mas Hitam in Bengkulu Province was estimated to be 978,000 tons in 1987. Coal produced by these companies mostly was either exported or consumed by domestic cement plants in South Sumatra.

P.T. Allied Indo Coal, a foreign coal contractor, reportedly completed a road for hauling coal from its Parambahan Mine to the nearby Ombilin Mine in October. It started coal production at an initial rate of 300,000 tons per year in November. Some of the Parambahan coal was exported to Malaysia in 1987.

P.T. Kideco Jaya Aguny (KJA), another foreign contractor, was developing a new coal mine at Samarangau in East Kalimantan and planned to begin production at 300,000 tons per year in 1988. KJA, which discovered coal reserves of 683 million tons in the Pasir deposit in October 1983, was a consortium of four companies from the Republic of Korea led by Samchuk Consolidated Coal Mining Co. Most of the coal produced by KJA initially would be delivered to the Suralaya powerplant in West Java. However, some coal will be exported when the output reaches 2 million tons per year in 1992.

After 5 years of exploration, P.T. Kaltim Prima Coal (KPC), also a foreign contractor, discovered a large, high-volatile bituminous coal reserve with a low ash, low sulfur, and high calorific value. The reserves are in the Pinang Coalfield, 20 kilometers from a deepwater port site on the east coast, north of Samarinda, East Kalimantan. According to KPC, coal reserves of six major coal seams and numerous minor seams were estimated at 150 million tons and were amenable to open pit mining. KPC, a joint venture of Conzinc Rio Tinto Ltd. of Australia and British Petroleum Ltd. of the United Kingdom, reportedly was conducting a market study for exporting most of the coal to Asian countries. KPC planned to start production in 1988.

Petroleum and Natural Gas.—Because of the OPEC quota, Indonesian crude oil production decreased slightly from that of 1986 but exceeded the OPEC quota of 1.133 million barrels per day. The output of crude oil, excluding condensate, averaged 1.24 million barrels per day compared with 1.26 million barrels per day in 1986. However, the output of condensate rose to an average of 153,000 barrels per day from 133,000 barrels per day in 1986.

In 1987, Indonesia exported 57% of its crude oil output, including condensate, principally to Japan, the United States, and the Republic of Korea, in order of value. Exports of crude oil and condensate in 1987 totaled 292 million barrels compared with 327 million barrels in 1986. Despite a decline in the volume of exports, export earnings for crude oil and condensate rose to $6.1 million from $5.4 million in 1986 because of higher prices. According to an industry source, the decline in exports was caused by OPEC restraints, low overseas demand, and increased crude oil consumption by domestic refineries. The export prices of Indonesian heavy crude oils were adjusted upward in August 1987 from $14.88 to $15.62 per barrel for Bima crude, from $15.60 to $16.10 for Duri crude, and from $17.10 to $17.20 for Cinta crude. The export price of Minas light crude remained at $17.56 per barrel in 1987.[12]

Asamera Oil Indonesia Ltd. reportedly

proved 15.4 million barrels of oil and 201 billion cubic feet of gas reserves at the Corridor block in South Sumatra after discovery in 1985. Asamera Oil and Bow Valley Industries of Canada, which signed a production-sharing contract with PERTAMINA, the state-owned oil and gas company, for joint exploration and development of oil and gas in 1983, began a 15-well development project. Commercial production was scheduled to start at 8,000 barrels per day in 1988. The joint venture was owned by Asamera Oil, 54%; Bow Valley, 36%; and PERTAMINA, 10%.

Oil and gas exploration continued its downward trend despite an improvement in the world oil market. The number of exploratory wells drilled dropped sharply to 82 from 156 in 1986, while seismic profiling declined to 27,730 kilometers from 28,734 kilometers in 1986. However, drilling of development wells reportedly increased substantially in 1987.

Encouraged by recovery of world oil prices, PERTAMINA signed seven new production-sharing contracts with foreign companies compared with three in 1986. The seven companies and their contract areas were Continental Oil Co. (Conoco) of the United States in the 43,944-square-kilometer Warim block onshore and offshore in western Irian Jaya; Britoil PLC of the United Kingdom in the 24,986-square-kilometer Sula block offshore central Sulawesi; Occidental Oil Co. of the United States in the 22,650-square-kilometer Bureau block off the west coast of Irian Jaya; Conoco and Shell in the 18,903-square-kilometer area onshore and offshore Buton Island in southeast Sulawesi; Shell BV of the Netherlands in the 12,630-square-kilometer Asem-Asem block offshore South Kalimantan; a joint venture of Chevron Corp. and Texaco Inc. of the United States in the 12,000-square-kilometer Manui block offshore southeast Sulawesi; and Enim Oil Corp., a subsidiary of Southern Cross Ltd. of the United States, in the 1,137-square-kilometer Lomatang block onshore in South Sumatra.

Natural gas production increased to a record-high level in 1987 owing to more output by Mobil Oil Indonesia (Mobil) from its Arun Gasfields in Aceh, North Sumatra. Mobil produced 759 billion cubic feet of natural gas accounting for 46% of the output. Mobil was followed by Roy M. Huffington Co., accounting for 22% and producing 379 billion cubic feet of natural gas from its Badak Gasfields in East Kalimantan. Of the gas produced, 53% was used for LNG; 23% for producer consumption; 9% flared; 8% for manufacturing nitrogen fertilizer materials; and 7% for use by cement, steel, and LPG plants, oil refineries, and the city gas and utility industries. Sales of natural gas totaled 1.2 trillion cubic feet in 1987.[13]

Indonesia remained the world's largest producer and exporter of LNG in 1987. Production and exports of LNG rose 10% to 866 trillion British thermal units or the equivalent of 407,000 barrels per day of crude oil because of new exports to the Republic of Korea. However, export earnings from LNG dropped 10% to $2.6 billion resulting from rebates to Japanese customers for overcharges in 1986 and lower price in 1987.

Indonesia made further progress in production and exports of LNG in 1987. Following the signing of a 20-year sales contract with the Republic of Korea in October 1986, Indonesia made its first shipment of LNG to that country in late 1986 at the rate of 2 million tons per year. Additionally, it has exported more than 15 million tons of LNG per year to Japan since 1985. In March, another 20-year sales contract was signed with Taiwan for PERTAMINA to supply 1.5 million tons per year of LNG to the Chinese Petroleum Co. beginning in 1990. The LNG pricing formula for Taiwan reportedly was identical to that of Japan. In August, PERTAMINA also signed a sales contract with Chubu Electric Power Co. of Japan to supply LNG to the company over a 3-year period at an annual rate of 700,000 tons beginning in October 1987.

To increase production capacity for increased exports of LPG to Japan, PERTAMINA awarded two construction contracts to two Japanese companies in February. A $700 million contract for a 1.6-million-ton-per-year plant at Arun in Aceh, North Sumatra, reportedly was awarded to a consortium led by JGC Corp. The other contract was awarded to Chiyoda Chemical Engineering & Construction Co. for a $179 million, 350,000-ton-per-year plant in Bontang, East Kalimantan. Both plants were scheduled for completion in 1988. Under a contract signed in July 1986 with seven Japanese importers, Indonesia was expected to supply 1.95 million tons of LPG over a 10-year period beginning in 1988 or 1989.[14] A $400 million contract to build a 1.5-million-ton-per-year LNG train at the Badak LNG plant in East Kalimantan was expected to be awarded in early 1988.

[1]Economist, Division of International Minerals.

[2]Where necessary, values have been converted from Indonesian rupiah (Rp) to U.S. dollars at the rate of Rp1,644=US$1.00.

[3]Far Eastern Economic Review (Hong Kong). V. 139, No. 7, Feb. 18, 1988, p. 75.

[4]U.S. Embassy, Jakarta, Indonesia. State Dep. Airgram A-022, Dec. 23, 1987, p. 1.

[5]Mining Journal (London). V. 308, No. 7919, May 29, 1987, p. 412.

[6]Freeport-McMoRan Inc. 1987 Annual Report. Pp. 18, 42, 47, 68, and 69.

[7]U.S. Embassy, Jakarta, Indonesia. State Dep. Telegram 19527, Dec. 16, 1987, pp. 1-8; and State Dep. Airgram A-006, Feb. 4, 1988, pp. 25-26.

[8]Metal Bulletin (London). No. 7241, Dec. 3, 1987, p. 27; No. 7256, Feb. 1, 1988, p. 23.

[9]U.S. Embassy, Jakarta, Indonesia. State Telegram 03532, Mar. 8, 1988, p. 1.

[10]Rock Products. V. 91, No. 4, Apr. 1988, p. 85.

[11]International Mining (London). V. 4, No. 9, Sept. 1987, p. 57.

[12] U.S. Embassy, Jakarta, Indonesia. State Dep. Telegram 02635, Feb. 23, 1988, p. 1.

[13]———. State Dep. Telegram 04915, Mar. 31, 1988, p. 1.

[14]———. State Dep. Telegram 02917, Feb. 29, 1987, p. 1.

The Mineral Industry of Iran

By Lloyd E. Antonides[1]

Iran's mineral industry continued to play a very prominent role in the economy of the country and even of the world. Petroleum remained the dominant mineral commodity. Oil production and prices were up in 1987, although prices weakened toward standard calendar yearend. Based on the limited information available, oil-generated revenues of about $12 billion[2] provided nearly one-third of the Government's total estimated revenues of about $37 billion and export oil sales were 75% to 85% of the country's total foreign exchange earnings of $12 billion to $13 billion in Iran's year ending March 20, 1988, here called fiscal year (FY) 1987. Iran was the world's seventh largest oil-producing country. In the Organization of Petroleum Exporting Countries (OPEC) it was the second largest after Saudi Arabia, providing 4.2% of the world's total production, compared with Saudi Arabia's 7.3%. Iran was in the top six countries in terms of oil reserves.[3]

Non-petroleum minerals and metals production apparently also increased. Iran ranked among the top 15 countries in production of cement, sulfur, and marketed natural gas. Gas reserves were estimated at about 13% of the world total, second only to those of the U.S.S.R. However, the natural gas and most of the cement were consumed domestically. Other crude mineral production important to Iran's economy included: coal; chromite; ores containing copper, iron, lead, manganese, and zinc; and a number of industrial minerals. Metal production important to the Iranian economy included steel, aluminum, and copper. The steel industry consumed all the domestic iron ore produced and most of the coal; copper smelting used most of the copper minerals. On the other hand, aluminum smelting used imported raw material. Noteworthy metal and nonoil mineral exports included copper and copper concentrates, lead and zinc concentrates, chromite, manganese ore, cement, sulfur, celestite, turquoise, and apparently coal.

Almost 800 mines employed almost 75,000 people, according to press reports of Government figures. Projections of other reportedly Government data indicate production of almost 50 million tons of about 35 nonoil raw minerals in FY 1987. Private firms and cooperatives were reported to operate about one-half of the producing units, with about one-third of the work force; the balance was presumably Government operated. It was unclear as to ownership of the units and whether any of these figures included the extractive metallurgical sector.

The estimated value of Iran's total nonoil mineral and metal production was in the $1 billion range in FY 1987 based on that tonnage and reports that Esfahan Province alone produced 7 million tons worth $150 million in FY 1986. The Mines and Metals Minister was quoted as saying metal and nonoil mineral exports totaled 486,000 tons, which generated income of $90.3 million in FY 1987, 6.2% more than in 1986. Copper, coal, and chromite were especially mentioned. The 1986 value was reported to be 22% higher than in 1985.

The domestic economy was strongly affected by the war with Iraq. Based on sketchy budget figures, the war siphoned off funds of probably $10 billion to $15 billion, roughly equal to the revenues from oil production. Nevertheless, the country seemed to cope with the conflict well enough to continue developing, expanding, and rebuilding its economy while working toward self-sufficiency in manufacturing

as well as in raw and basic materials. Gross domestic product (GDP) was estimated by several sources to be more than 9 trillion Iranian rials which, however variously converted, was equivalent to well over $100 billion. Reportedly, the GDP showed an increase of about 1% to 2% in 1987, although the currency measure used was unclear. With Iran's population at about 50 million, such figures indicate a comfortable per capita GDP of about $2,000. However, reports said industrial output failed to improve because of increased diversion to war production. Some commodities were rationed. These included not only gasoline and kerosene, at least partly due to refinery war damage, but also meat and some other basic foodstuffs in short supply for unexplained reasons. Shortages of some normally imported industrial supplies and equipment reulted from the war demands on foreign exchange. Prices for consumer goods probably rose 20% to 25% although Government officials claimed the rate was held to 15%, while critics contended it was 40% to 50%. Unemployment was indicated by several sources to be about 30% of a work force numbering almost 15 million, but there was a shortage of skilled labor.

A reported trade-balance estimate for FY 1987, made in March 1988, showed a positive balance of $1 billion, based on $10.5 billion in exports and $9.5 billion in imports. For FY 1986, the comparable figures indicated a deficit of $2.5 billion, with exports at $7.5 billion and imports at $10 billion.

Foreign debt was apparently considered reasonable. Short-term, trade-related loans of about $3 million and other larger foreign claims were offset by Iran's own sizable claims to funds and other assets that had been blocked since shortly after the start of the 1979 revolution. These claims continued to be resolved in various courts and conferences. Foreign exchange reserves in banks rose during the year and were believed to be comfortable at about $6 billion at yearend. Iran's other foreign assets and claims may exceed that figure. Partial payments on some claims, such as the $300 million paid by France and the $451 million paid by the United States in late 1986 and early 1987, helped to increase foreign exchange holdings, as did the higher oil export revenues.

The international political events that affected the economy most were those related to the Iran-Iraq war. Iran continued to resist all pressures to comply with United Nations resolutions on a cease-fire and instead stepped up its war activities. There were also diplomatic difficulties with other neighbors and Western European countries. After Kuwaiti tankers were reflagged as U.S. vessels in May, U.S. Naval forces, as well as those of other European nations, took action to protect neutral shipping in the Persian Gulf and a major military confrontation developed, particularly with the United States. In July, France severed relations over a diplomatic dispute and asked French companies and other European countries to stop purchases of Iranian oil. At the end of October, the U.S. President by executive order banned imports of Iranian oil and other goods not already under contract. The United States also expanded its list of items banned from export to Iran. The Government claimed the actions were due to a number of reasons: a sudden and large rise in oil imports from Iran that caused concern over U.S. energy security; the suspicion that Iran's hard-currency revenues were supporting terrorism and in prolonging refusal to consider a cease-fire; Iran's continued attacks on neutral shipping; and the escalating engagements between Iranian and United States forces. The United States also pressured other countries to join the oil embargo, especially Japan. Although no formal action was taken, Japanese purchases probably were reduced. However, the calendar year ended with the Iran-United States confrontation appearing to stabilize.

Iran and the U.S.S.R. enhanced their relations at several conferences. There was agreement on new and renewed technical help for several projects such as the Esfahan steel mill, and discussions continued on using U.S.S.R. pipelines to export Iranian oil through Black Sea ports and on joint-venture oil drilling in the Caspian Sea.

Internally, Iran's commercial-industrial structure consisted of a mixture of government organizations, parastatal "foundations," cooperatives, and private companies and individuals. This system together with a framework of old, new, and revised laws, regulations, decrees and other documents, apparently was a puzzle to Iranians as well as foreigners. It was considered by many to be very detrimental to the economy and to dampen hopes for its improvement. A start at resolving the situation apparently was under way. Work reportedly had begun on drafting new laws and regulations that

better defined the legal status, functions and relationships of the various elements. In October, a new oil act formally placed all oil-related operations under Government authority and defined the functions of the Ministry of Oil. Also a new holding company was formed to coordinate several companies within the jurisdiction of the Ministry of Mines and Metals.

Information on the mineral industry in Iran was simply not available from Government and/or private industry associations as in most other countries. Thus, much of the information presented here is based on reports from a number of publications, especially Middle East Economic Digest (London) and Mining Journal/Mining Magazine (London).

PRODUCTION AND TRADE

Despite continued Iraqi attacks on Iranian petroleum facilities throughout the year, crude oil production reportedly averaged 2.4 million barrels per day (bbl/d) worth possibly $11 billion to $13 billion. That was a 20% increase in quantity over 1986 and 1 million bbl/d barrel per day increase over that announced for 1981, the first full year of the Iran-Iraq hostilities.

Revenues in 1987 were proportionately higher due to higher oil prices. Iran exported an average of 1.7 million bbl/d of crude oil in 1987 about the same quantity as in 1986. The exported oil was worth close to $10 billion, a significant increase in value. Markets were principally Japan, Europe (mostly the Netherlands, Italy, France, and Spain), the United States, and Turkey.

In the first 6 months of 1987, U.S. imports from Iran averaged 180,000 bbl/d at a total period cost of $810 million, whereas for the entire previous year imports averaged only 93,000 bbl/d at a total period cost of $505 million. In July, imports escalated to 632,000 bbl/d at a cost of $357 million for that month alone. Such a sharp, high rise in imports—together with continuing political confrontations and military engagements—resulted in a U.S. ban, effective October 29, on imports of Iranian oil and other goods not already contracted. However, that still allowed sizable U.S. imports of Iranian oil to continue at least through yearend. After France broke diplomatic relations in July and asked French companies not to buy Iranian oil, Iran decided to counteract the loss of markets in those two countries and sought buyers in northwestern Europe. This was done by shipping 13 million barrels of unsold crude oil to Rotterdam, Netherlands, where it could be sold at the lower basis of c.i.f. rather than f.o.b. in the Persian Gulf. Crude stored in tankers at Rotterdam was offered at a discount of $1.00 to $1.20 less than the f.o.b. price in the Persian Gulf. Far East buyers, particularly Japan, then requested price parity with European buyers and reduced their Persian Gulf liftings by one third, or about 100,000 bbl/d to pressure the National Iranian Oil Co. (NIOC) for price reduction.

Iran continued to rely on imports for much of its requirements for middle-distillate products. Capacity expansions at the Tehran, Esfahan, Bakhtaran and Lavan refineries had not offset the loss caused by the destruction in 1980 of the nation's largest refinery at Abadan. In 1987, Iran imported approximately 330,000 bbl/d of middle distillate products derived from custom processing arrangements involving 450,000 bbl/d of Iranian crude oil. About a dozen refiners were involved in these 3- to 12-month agreements, which individually covered processing up to 80,000 bbl/d but mostly between 20,000 and 45,000 bbl/d. Refineries that participated were apparently scattered throughout the world, including the Republic of Korea, Singapore, Yemen (Aden) and Spain as well as African and Western Hemisphere countries. Iranian crude was exchanged for petroleum products at a rate of 1 barrel of crude oil for 0.7 barrels of products. To supplement these crude-for-product agreements, Iran purchased an additional 70,000 bbl/d of middle distillates on the open market in 1987. Refined products started to enter from the U.S.S.R. through the Caspian Sea Port of Bandar Anzali for pipelining to Rasht and further distribution by pipeline and other means.

Countertrade apparently was increasingly emphasized by Iranian officials, especially by payment in oil for imports. However, the practice was reportedly extended to nonoil exports. In late 1985, the Bank Markazi (central bank) estimated that up to 40% of Iranian trade involved countertrade, only one-half of which was traditional barter. The proportion of countertrade was likely to have increased since then. At least several Eastern European countries, India, and Pakistan were said to have been involv-

ed in 1987.

Gross production of natural gas reportedly was up and exceeded 1.1 billion cubic feet. About one-half of this output was consumed in satisfying industrial, residential, and electric power demands. Most of the remaining gross production was reinjected for pressure maintenance in oilfields. Less than 0.2 billion cubic feet were flared or vented.

Nonoil minerals and metals production also was reported higher for the year, especially for some key commodities. Steel and coal production were said to have increased 15% and 13%, respectively, over the first 10 months, to 1.1 million and 540,000 tons, respectively. Steel production for the year was later reported at 1.5 million tons. Substantial production increases also were claimed for copper concentrate and metal.

Nonoil minerals and metals exports were announced by the Mines and Metals Minister to be up 6.2% in value to $90.3 million. The Minister cited copper, coal, and chromite in particular.

The following tables may not reflect data mentioned in the text due to lack of reliable confirmation at time of preparation.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum metal, primary ingot[e]	39,200	[3]42,400	43,000	[r]40,000	39,800
Chromium: Chromite, mine output, gross weight[e]	48,000	59,000	56,000	56,000	56,000
Copper:					
Mine output, Cu content	57,600	43,300	50,000	60,000	60,000
Metal:					
Smelter output, primary blister	8,500	47,900	60,000	60,000	60,000
Refinery output, primary refined	10,000	5,000	12,000	12,000	12,000
Iron and steel:					
Iron ore, mine output:					
Gross weight[e] thousand tons	1,700	2,700	2,800	2,800	2,800
Fe content[e] do.	950	1,550	1,600	1,600	1,600
Metal:					
Pig iron[e] do.	240	250	250	250	250
Steel, crude[e] do.	1,200	1,200	900	900	900
Lead, mine output, Pb content[e]	[3]18,500	[3]19,900	21,600	21,600	21,600
Manganese, mine output, gross weight[e]	38,000	66,000	55,000	55,000	55,000
Molybdenum, mine output, Mo content[e]	500	500	500	500	500
Zinc, mine output, Zn content	39,500	47,100	50,000	36,000	36,000
INDUSTRIAL MINERALS					
Asbestos, conentrate[e]	2,500	2,500	2,500	3,000	3,300
Barite[e]	85,000	90,000	90,000	90,000	90,000
Boron: Borax[e]	700	700	1,200	1,200	1,200
Cement, hydraulic thousand tons	[e]10,000	11,803	12,464	12,273	12,300
Clays:					
Bentonite	14,000	35,000	27,000	[e]27,000	27,000
Kaolin and fire clay[e]	260,000	622,000	429,000	430,000	430,000
Feldspar[e]	24,000	33,000	32,000	32,000	32,000
Fluorspar: Fluorite[e]	3,300	3,300	3,300	3,300	3,300
Gem stones: Turquoise kilograms	37,444	37,073	34,671	[e]35,000	35,000
Gypsum thousand tons	8,637	9,666	8,384	[e]8,400	8,400
Lime[e] do.	650	650	[r]650	650	650
Magnesium compounds: Magnesite[e]	[r]5,000	[r]5,000	[r]5,000	5,000	5,000
Mica	300	565	820	[e]820	820
Nitrogen: N content of ammonia	[e]28,800	[e]21,400	27,100	65,900	119,200
Pigments, mineral, natural iron oxide	3,500	9,100	4,300	[e]4,300	4,300
Salt, rock thousand tons	682	691	703	[e]700	700
Sodium compounds, n.e.c: Caustic soda[e]	12,500	12,000	12,000	12,000	12,000
Stone, sand and gravel:[e]					
Crushed: Limestone thousand tons	12,948	11,574	15,430	16,000	16,000
Dimension: Marble, granite, travertine do.	2,900	3,072	3,291	3,300	3,300
Strontium minerals: Celestite	[r]21,000	[r]23,000	[r]20,000	22,000	22,000
Sulfates, natural:					
Aluminum-potassium sulfate (alum)[e]	2,500	12,000	12,000	12,000	12,000
Sodium sulfate (mineral not specified)[e]	12,000	12,000	12,000	12,000	12,000
Sulfur:					
Native[e] thousand tons	20	30	30	30	30
Byproduct of petroleum and natural gas do.	16	130	150	[r e]250	300
Total[e] do.	36	160	180	280	330
Sulfuric acid[e] do.	150	200	200	200	200
Talc	5,700	35,400	30,800	[e]31,000	31,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS					
Coal thousand tons	[r]800	[r]907	[r]1,270	1,262	1,275
Coke[e] do.	[r]330	[r]349	[r]399	349	375
Gas, natural:					
Gross million cubic feet	[r]908,000	1,077,000	1,257,000	1,165,000	1,200,000
Marketed do.	[r]327,000	[r]494,000	661,000	557,000	596,000
Natural gas liquids, unspecified thousand 42-gallon barrels	[r]2,900	3,600	3,600	3,500	7,300
Petroleum:					
Crude do.	890,600	793,510	[r]821,250	742,775	885,490
Refinery products:					
Gasoline, motor do.	[r]28,835	[r]34,675	24,820	25,915	20,000
Kerosene and jet fuel do.	[r]35,770	[r]42,705	24,820	25,185	20,000
Distillate fuel oil do.	[r]52,925	[r]57,305	75,555	80,300	65,000
Residual fuel oil do.	[r]60,225	[r]86,870	68,985	74,095	60,000
Other do.	[r]29,200	[r]31,025	35,405	35,040	30,000
Total do.	[r]206,955	[r]252,580	229,585	240,535	195,000

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

[1]Data are for fiscal year beginning Mar. 21 of that stated, except those for "Mineral Fuels and Related Materials," which are for standard calendar years. Table includes data available through Oct. 1, 1988.

[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. Mine output may be mine run and/or hand-selected ore, and/or concentrates from mill-concentrator, unless otherwise specified.

[3]Reported figure.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Scrap	20	--		
Semimanufactures	--	8	8	
Chromium: Ore and concentrate	317	--		
Copper:				
Matte and speiss including cement copper	--	492	--	All to Greece.
Metal including alloys:				
Scrap	49	267	--	West Germany 208; Spain 42.
Unwrought	--	25,492	--	West Germany 11,345; Belgium-Luxembourg 9,884.
Gold: Metal including alloys, unwrought and partly wrought troy ounces	707	--		
Iron and steel: Metal, scrap	594	2,360	--	All to Japan.
Lead: Ore and concentrate	18,404	5,698	--	Greece 2,850; France 2,848.
Molybdenum: Ore and concentrate	262	152	--	West Germany 77; United Kingdom 75.
Platinum-group metals: Waste and sweepings value, thousands	$127	--		
Silver:				
Ore and concentrate do.	--	$126	--	Spain $102; France $24.
Waste and sweepings[2] do.	$21	$391	--	All to Netherlands.
Tin: Metal including alloys, unwrought	--	60	60	
Zinc:				
Ore and concentrate	21,443	2,280	--	All to West Germany.
Ash and residue containing zinc	487	1,009	--	West Germany 430; Belgium-Luxembourg 364; France 215.
Zirconium:				
Ore and concentrate	13,625	NA		
Metal including alloys, unwrought	--	20	--	All to Italy.
Other:				
Ores and concentrates value, thousands	$991	--		
Ashes and residues	487	--		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	--	1	1	
Dust and powder of precious and semiprecious stones including diamond value, thousands	$8	--		
Grinding and polishing wheels and stones ---do---	$2	--		
Clays, crude	5	1	--	All to Italy.
Diamond:				
Gem, not set or strung value, thousands	$17	$526	$523	France $3.
Dust and powder:				
Natural ---do---	$19	--		
Synthetic ---do---	$88	$173	$173	
Magnesium compounds, unspecified	--	1	1	
Precious and semiprecious stones other than diamond:				
Natural ----- value, thousands	$12	$49	--	Taiwan $38; West Germany $9.
Synthetic ---do---	$4	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked -----	2,104	2,569	(3)	Italy 1,387; Japan 1,090.
Worked	--	36	(4)	West Germany 20; Italy 15.
Limestone other than dimension value, thousands	$2	--		
Sulfur: Elemental, crude including native and byproduct	13,146	11,545	--	All to Thailand.
Other: Crude	--	100	--	All to Japan.
MINERAL FUELS AND RELATED MATERIALS				
Peat including briquets and litter -----	--	63	--	All to United Kingdom.
Petroleum:				
Crude thousand 42-gallon barrels	r257,360	283,892	33,957	Japan 91,675; Netherlands 28,929; Spain 24,203.
Refinery products:				
Gasoline ---do---	461	144	--	All to Spain.
Distillate fuel oil -----do---	10	90	--	All to Yugoslavia.
Residual fuel oil -----do---	r1,627	192	--	Belgium-Luxembourg 176; Italy 16.

rRevised. NA Not available.

[1]Table prepared by Virginia A. Woodson. Owing to a lack of 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 partner trade countries. Unless otherwise specified, data are compiled from trade statistics of individual trading partners.

[2]May include platinum-group metals.

[3]Unreported quantity valued at $44,000.

[4]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth	2	--		
Aluminum:				
Oxides and hydroxides	26,152	14,397	--	Italy 12,876; West Germany 873.
Metal including alloys:				
Unwrought	2,171	26	--	All from Pakistan.
Semimanufactures	r12,597	7,673	184	Switzerland 3,099; Belgium-Luxembourg 1,562.
Antimony: Oxides	67	--		
Chromium: Oxides and hydroxides	189	219	--	United Kingdom 114; Japan 102.
Cobalt: Metal including alloys, all forms	--	5	--	Italy 3; West Germany 2.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Copper:				
Oxides and hydroxides	--	7	--	United Kingdom 6; Belgium-Luxembourg 1.
Metal including alloys:				
Unwrought	459	1	--	All from West Germany.
Semimanufactures	r49,581	16,180	3	West Germany 7,303; Japan 4,469; Yugoslavia 1,940.
Gold: Metal including alloys, unwrought and partly wrought value, thousands	--	$6	--	All from United Kingdom.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	14	--		
Metal:				
Pig iron, cast iron, related materials	1,404	1,999	--	Italy 928; West Germany 573; Sweden 233.
Ferroalloys:				
Ferrochromium	--	66	--	West Germany 36; France 30.
Ferromanganese	12,043	768	--	Norway 551; Sweden 147; West Germany 70.
Ferrosilicon	--	460	--	All from Yugoslavia.
Unspecified	327	2,064	--	Norway 944; West Germany 843; Sweden 147.
Steel, primary forms	r998,328	156,783	--	Australia 99,790; West Germany 31,633; Belgium-Luxemborurg 11,375.
Semimanufactures:				
Bars, rods, angles, shapes, sections	r859,801	90,744	--	Japan 35,922; West Germany 27,902; Spain 10,106.
Universals, plates, sheets	r1,300,500	390,164	--	Japan 216,003; Spain 65,638; West Germany 42,290.
Hoop and strip	r77,410	23,591	--	Japan 10,761; West Germany 8,270.
Rails and accessories	r10,990	4,613	--	Japan 1,797; West Germany 1,381; Austria 1,307.
Wire	r29,209	11,041	--	Japan 6,557; Belgium-Luxembourg 1,722; West Germany 910.
Tubes, pipes, fittings	r242,501	132,052	9	Japan 54,099; West Germany 44,262; Italy 25,674.
Castings and forgings, rough	r1,250	930	--	Japan 860; West Germany 68.
Lead:				
Oxides	126	23	--	All from United Kingdom.
Metal including alloys:				
Unwrought	11,170	5,708	--	Italy 5,703.
Semimanufactures	31	31	--	Japan 25; United Kingdom 4.
Magnesium: Metal including alloys:				
Unwrought	7	--		
Semimanufactures	19	17	--	Switzerland 16.
Unspecified	3	--		
Manganese:				
Ore and concentrate, metallurgical-grade	1,500	--		
Oxides	500	--		
Mercury 76-pound flasks	174	64	--	Spain 58; Japan 6.
Molybdenum: Metal including alloys, all forms	--	1	--	All from Belgium-Luxembourg.
Nickel: Metal including alloys:				
Unwrought	60	1	--	All from West Germany.
Semimanufactures	36	15	--	West Germany 7; United Kingdom 5.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$1,379	$201	--	West Germany $158; Switzerland $37.
Selenium, elemental	--	5	--	All from United Kingdom.
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$578	$611	--	Yugoslavia $358; West Germany $142; United Kingdom $97.
Tin: Metal including alloys:				
Unwrought	11	28	--	Netherlands 23; Italy 4.
Semimanufactures	7	26	--	All from West Germany.
Titanium:				
Ore and concentrate	--	131	--	All from Netherlands.
Oxides	295	348	--	United Kingdom 179; Japan 122; West Germany 47.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Tungsten: Metal including alloys, all forms	6	2	--	Belgium-Luxembourg 1; United Kingdom 1.
Zinc:				
Oxides	106	284	--	United Kingdom 249; Belgium-Luxembourg 34.
Metal including alloys:				
Unwrought	r10,518	3,665	--	West Germany 1,126; Spain 1,100; Italy 1,000.
Semimanufactures	1	7	--	All from Italy.
Zirconium: Ore and concentrate	--	36	--	All from Netherlands.
Other:				
Ores and concentrates	1,160	--		
Oxides and hydroxides	32	1	--	All from Belgium-Luxembourg.
Ashes and residues	82	--		
Base metals including alloys, all forms	--	6	--	West Germany 3; Italy 3.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	97	89	--	Italy 65; Spain 19.
Artificial: Corundum	13	25	--	All from Italy.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$888	$7	--	West Germany $4; United Kingdom $3.
Grinding and polishing wheels and stones	r1,881	860	--	West Germany 337; Yugoslavia 204; United Kingdom 147.
Asbestos, crude	9,619	20	--	All from Italy.
Boron materials: Oxides and acids	r1,320	20	--	All from Netherlands.
Cement	6,224	2,668	--	West Germany 1,286; Japan 806; Yugoslavia 500.
Chalk	1,324	--		
Clays, crude:				
Bentonite	--	425	--	United Kingdom 416.
Chamotte earth	--	98	--	All from Italy.
Kaolin	--	860	--	United Kingdom 824; West Germany 36.
Unspecified	r3,357	500	--	All from Austria.
Diamond:				
Gem, not set or strung value, thousands	$427	--		
Industrial stones do.	$890	$637	--	All from Switzerland.
Diatomite and other infusorial earth	134	41	--	West Germany 19; Iceland 10; Japan 10.
Fertilizer materials:				
Crude, n.e.s	99	--		
Manufactured:				
Ammonia	11	16	--	France 9; Netherlands 4.
Nitrogenous	149,434	465	--	All from West Germany.
Phosphatic	30,750	176,299	--	Philippines 110,411; Tunisia 65,888.
Potassic	--	36	--	All from West Germany.
Unspecified and mixed	40	1,804	--	Belgium-Luxembourg 1,529; Switzerland 249.
Graphite, natural	45	95	--	West Germany 94; United Kingdom 1.
Gypsum and plaster	--	178	--	West Germany 159; United Kingdom 11.
Iodine	--	2	--	All from Netherlands.
Magnesium compounds:				
Magnesite, crude	r5,674	2,082	--	Austria 2,000; Italy 50; West Germany 32.
Unspecified	--	20	--	All from West Germany.
Mica:				
Crude including splittings and waste	36	--		
Worked including agglomerated splittings	2	--		
Pigments, mineral: Iron oxides and hydroxides, processed	138	--		
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$105	$35	--	Do.
Synthetic do.	$4	--		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Salt and brine	r2,839	364	--	West Germany 359; United Kingdom 5.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	r30,101	5	--	All from West Germany.
Sulfate, manufactured	r6,951	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	--	24	--	All from Sweden.
Worked	243	39	--	Italy 33; United Kingdom 5.
Gravel and crushed rock	1,117	9,367	--	Italy 9,351.
Limestone other than dimension	--	17	--	All from Japan.
Quartz and quartzite	r32	21	--	Italy 16; Yugoslavia 4.
Sand other than metal-bearing	460	20	--	West Germany 19; Switzerland 1.
Sulfur:				
Dioxide	--	12	--	All from West Germany.
Sulfuric acid	37	12	--	United Kingdom 8; Japan 4.
Talc, steatite, soapstone, pyrophyllite	72	--		
Other:				
Crude	1,469	--		
Slag and dross, not metal-bearing	--	9,300	--	All from Netherlands.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,611	--		
Carbon black	691	26,850	--	Argentina 26,813.
Coal:				
Anthracite and bituminous	231,638	418,133	--	Australia 414,800; United Kingdom 3,333.
Briquets of anthracite and bituminous coal	--	81	--	All from United Kingdom.
Lignite including briquets	104	--		
Coke and semicoke	681	13	--	Do.
Petroleum refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	(2)	1	--	Mainly from United Kingdom.
Gasoline do	1,122	401	--	Italy 204; Spain 197.
Mineral jelly and wax do	636	3	--	Belgium-Luxembourg 1; Netherlands 1.
Kerosene and jet fuel do	11,452	10,084	--	Spain 6,121; Italy 1,677; Japan 1,060.
Distillate fuel oil do	6,698	3,709	--	Italy 2,055; Japan 1,652.
Lubricants do	567	323	(2)	France 107; Netherlands 88; United Kingdom 54.
Residual fuel oils do	62	--		
Bituminous mixtures do	(2)	2	--	All from United Kingdom.
Petroleum coke do	72	32	--	West Germany 21; United Kingdom 11.

rRevised.

[1]Table prepared by Virginia A. Woodson. Owing to a lack of official trade data published by Iran, this table should not be taken as a complete presentation of Iran's mineral imports. Unless otherwise specified, data are compiled from trade statistics of individual trading partners.

[2]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—The 50,000-ton-per-year (tpy) Iranian Aluminum Co. smelter at Arak, about 250 kilometers southwest of Tehran, apparently continued to produce at about 80% capacity and to work on expansion to 120,000 tpy by 1990. Imported alumina was used, probably principally from India. No further information was received on the damage inflicted on the plant by the Iraqi Air Force in 1986 or on plans for a second 120,000-tpy smelter at Bandar-e 'Abbas due for completion in the early 1990's.

Negotiations were reported under way between Iran and Eastern European countries to establish plants for processing what was referred to as substantial aluminum mineral resources. The deposits referred to as alunite, bauxite, and nepheline-syenite,

were still being explored. Very large deposits of alunite grading above 22% Al_2O_3 in the northwest (Azerbaijan Provinces) were mentioned. However, the deposits of bauxite were said to be more suitable for use as "hard clay," presumably for refractory brick.

Chromium.—A number of chromite mines were reported to have produced about 56,000 tons of concentrate from three main areas: in the southeast, starting about 100 kilometers east of Bandar-e 'Abbas and extending north about 100 kilometers; in the northeast, starting near Shahrud about 300 kilometers east of Tehran and extending east-southeast about 300 kilometers to southeast of Mashhad; and in the south about 100 kilometers east of Shiraz. Reserves were estimated to total more than 100 million tons at 30% to 50% chromite (Cr_2O_3). Major operations were Government owned and, according to reports, used underground mining with simple processing to produce a 60% chromite concentrate for export.

Copper.—A large portion of the copper metal produced by the National Iranian Copper Industries Co. Sar Cheshmeh complex, reportedly was exported. The complex was originally planned to meet only domestic needs. Consisting of an open pit, froth flotation concentrator, reverberatory smelter and electrolytic refinery, it is about 150 kilometers southwest of Kerman, near the center of a copper belt extending about 200 kilometers northwest and 200 kilometers southeast. Through mid-1988, reports of reserves ranged from 450 million tons proven at 1.2% copper with substantial other values, to 1.2 billion tons with class and grade unspecified.

Startup took several years in the early 1980's. Design capacity was based on production of 145,000 tpy of refined copper. However, in 1985 "nominal" output capacity was reported to be slightly higher: 15 million tpy of ore, 515,000 tpy of copper concentrate plus 3,600 tpy of molybdenum-rhenium concentrate, 150,000 tpy of anode blister copper, and 170,000 tpy of cathode refined copper. In addition, annual capacity in byproducts was reported to be at least 30 tons of nickel, 400 kilograms of gold, 22 tons of silver, and [illegible] tons of selenium. Judging from data in various publications through mid-1988, actual production in calendar 1987 probably was slightly under 30% of "nominal" for mine, concentrator, and smelter, but no more than 15% for the refinery. Since startup, reports have frequently mentioned plans and/or investments to expand or upgrade parts of the complex. Most recently for example, the concentrator was to be expanded by 60,000 tpy and the smelter by 40,000 tpy by yearend 1988; smelter matte output was to be "doubled by 1990"; refinery capacity was to be increased by 70,000 tpy in the near future. However, authoritative confirmation was lacking and production increases were not apparent; but the mention of starting metal exports suggested that some expansion was possibly completed.

The Qaleh Zari Mine and concentrator, also state-owned, about 100 kilometers south of Birjand and about 250 kilometers northeast of Kerman in southern Khorasan, was reported to have produced 250,000 tons of 3.1% copper ore that yielded 70,000 tons of 22% to 27% copper concentrates containing some gold and silver. The figures were questionable since less than one-half that quantity of that typical marketable grade of concentrate was possible from that tonnage and grade of ore. Also, if that ore production was an annual rate, the mine would have been one of Iran's larger mines. Exports of copper concentrates have been regularly reported, however, probably from Qaleh Zari and mines other than Sar Cheshmeh.

Other copper deposits are known to occur about 200 kilometers north and south of Qaleh Zari, as well as in the northeast, northwest and central areas of Iran.

Ferrosilicon.—A $90 million ferrosilicon plant, reputed to be the first in Iran and largest in the Middle East, was reported to have been under construction since mid-1986 at Semnan, 175 kilometers east of Tehran. However, in 1986 reports had mentioned a new state company formed to build a high-priority 20,000-tpy plant at Azna, about 325 kilometers southwest of Tehran, to satisfy most of the gulf states needs.

Gold.—In the Muteh area, about 150 kilometers northwest of Esfahan, detailed exploration around existing mines reportedly resulted in much larger gold reserves: 50 million tons of sulfides containing 4 grams per ton (0.117 troy ounce per short ton). In 1986, the Government announced reserves of 1.2 million tons grading slightly higher at the Muteh Mine where plans for a 200-ton-per-day ore-treatment plant had been reported even earlier.

Iron and Steel.—The Esfahan steel plant continued to be the principal domestic producer of iron and steel as it had been since

startup in the early 1970's. Built with Soviet technical help and equipment, it now has two blast furnaces and appreciable downstream facilities after several expansions and/or renovations. Similar work was reported to have begun again in 1987 with the arrival of Eastern European technicians and equipment, apparently to increase actual capacity from about 1.3 million tpy of raw steel bar up to an earlier design capacity of 1.9 million tpy. However, usually reliable information also indicated that output at best approached only 900,000 tpy of crude steel in 1987 due to many continuing problems including shortages of parts, coal and coke skilled labor, and others.

Although the Esfahan plant was probably the only major crude steel producer and the only one using iron ore, press reports attributed a statement to the Ministry of Mines and Metals that 1.5 million tons of raw steel was produced countrywide in 1987. Another report mentioned a Government production announcement of "2.3 million tons of steel in different forms." The difference may have reflected additional production from various small scrap remelting operations and possibly the plant at Ahwaz.

At Ahwaz, a second steel complex was originally designed in the early 1970's to produce 2.8 million tpy of steel in electric arc furnaces, processing scrap, and direct-reduced iron (DRI) apparently produced by three different natural-gas-fueled processes: Purofer, HYL, and Midrex. Although at least one Purofer unit was reportedly started in 1977, the plant shut down in 1979 perhaps at least partly due to political events. Since then, the complex has been periodically reported to be in final construction, undergoing repair of damage by Iraqi forces (especially severe in 1985), or being expanded. The only reported production was 250,000 tons of raw steel in 1983. In 1987, basic installations apparently consisted of six electric furnaces, of which at least one was war damaged and possibly repaired; two 400,000-tpy Midrex DRI units (out of three planned); and at least some partly completed 250,000-tpy HYL DRI units (out of four planned). Completion of the 400,000-tpy third unit at Ahwaz, presumably the Midrex DRI plant, continued to be on the Government's high-priority-project list, according to press reports.

A third major steel complex costing $4.7 billion was said to be scheduled for completion in 1993 at Mubarakeh about 40 kilometers south of Esfahan and 20 kilometers beyond the existing steel plant. Apparently this newest steel plant was originally scheduled for completion in 1983 at Bandar-e 'Abbas. Plans reportedly included electric arc furnaces using DRI from Midrex natural gas units. The former were reportedly being supplied by the Italian prime contractor Societa Italiana Inipianti S.p.A. and the latter by the Japanese firm Kobe Steel Ltd. Design output apparently was about 2.5 million tpy of raw steel.

Feed to the steel plants reportedly was planned to be primarily magnetite concentrates transported by rail from existing and new open pit mines such as Choghart and Chadarmalu, respectively, centered just north of Bafq about 100 kilometers east of Yazd and midway between Esfahan and Kerman; and a new open pit, Golgohar, about 300 kilometers south of Bafq near Sirjan. Other deposits with some potential had been noted further south near Bandar-e 'Abbas, particularly Tangezagh; and also in the west just south of Arak about 250 kilometers northwest of Esfahan, where Shamsabad and others were located. Known occurrences were also scattered between the northwest and the northeast as well.

In addition, some concentrates and/or pellets had, at one time at least, been supplied to the Esfahan plant by India's Kudremukh project, which started in the 1970's as a joint venture with Iran. Continuing discussions regarding Iran's further participation were reported.

Choghart was reported to have about 300 million tons of reserves of magnetite "ore" of unspecified grade and to have been the major ore producer with output apparently more than 2 million tons of "56% Fe_2O_3 in 1987."[4] (Ore grades normally are reported as percent iron rather than iron oxide.) Nearby, the Chadarmalu Mine was variously reported to have 350 million tons of proven ore grading 59% iron and 1% phosphorus and more than 2 billion tons of reserves of ore grading more than "56% Fe_2O_3."[5] It was said to be planned for production of 3 million tpy of ore or at least 1.5 million tpy of concentrates by 1990 for feeding the Mubarakeh complex. At Golgohar, reserves of more than 1 billion tons were claimed and production was reported to be planned at 5 million tpy of ore, resulting in at least 2.4 million tpy of magnetic concentrates containing 70% iron and 0.016% phosphorus, also for the Mubarakeh iron plant. Development of Golgohar started in the 1960's with Swedish technical as-

sistance that continued through 1987 albeit with some interruptions; startup had been scheduled for 1987.

Lead and Zinc.—Many lead-zinc deposits make up Iran's significant known reserves of zinc. A large number were scattered in a band roughly 200 kilometers wide, extending from the Angouran Mine, the largest producer, about 200 kilometers southeast of Tabriz and 100 kilometers west of Zanjan, southeasterly 750 kilometers to the Qanat Marvan Mine about 100 kilometers south of Kerman. There were two major concentrations within this zone: one centered northwest of Esfahan and the other east of Yazd. A narrower band of deposits ran northeast from the Yazd-Bafq center to Mashhad, and other deposits were north and east of Tehran.

A number of mines were obviously active, based on reports of substantial and increasing exports of zinc and lead concentrates. Reports also indicated sitework had started and process plant contracts were being finalized with two firms from the Federal Republic of Germany. Lurgi GmbH was negotiating for an electrolytic zinc section and Mannesmann Demag for a lead section at a proposed $67 million smelting complex at Zanjan, which had been planned for a number of years. Design output of 40,000 tpy of lead and 60,000 tpy of zinc was mentioned, with startup targeted for 1990. Other new smelters, especially a zinc plant with 14,000- to 24,000-tpy output in the Yazd-Bafq area, were also reported as being considered or under negotiation.

Manganese.—Approximately five open pit operations were cited as collectively producing 55,000 to 60,000 tons of manganese ore in 1987, at least some of which was said to contain about 29% manganese, which needed no dressing. Reportedly, some production was exported, although statistical data showed only imports. Apparently, the most important mines were about 50 kilometers southwest of Tehran, although a major deposit was identified several years ago about 30 kilometers south of Qom and another report mentioned mining activity centered in the Yazd area.

Titanium.—Titanium mineral deposits were reported found near "Khanoodj" in southern Iran and described as "huge" reserves.[6] Three million tons of massive ilmenite and 20 million tons of mineral sands had been mapped.

INDUSTRIAL MINERALS

Asbestos.—Although asbestos, as well as chromite and magnesite, was known to occur in ophiolitic rock environments in Iran and nearby countries, one of the few published reports of Iranian production stated that in 1987 3,300 tons of fiber was extracted from 53,000 tons of ore grading 3% to 8% fiber mined south of Birjand. The report cited reserves estimated at 50 million tons of dunitic rock grading 5% to 10% asbestos but prospecting since 1985 indicated many times as much tonnage. This may be the same major deposit identified in a 1977 report, about 275 kilometers northwest of Zahedan, which is the same area. In 1986, a 50-million-ton reserve of asbestos ore was also reported near Tabas, 230 kilometers northwest of Birjand. A 1985 report on Iran showed 55,600 tons of asbestos being mined during FY's 1981 and 1982; and a 1987 report gave production of 2,500 tons of asbestos concentrate in 1986.

Cement.—Negotiations for construction of two new cement plants in the northeast were reported being finalized by Bojnurd Cement Co. and Khorassan Cement Co. with Japanese firms. Each plant was to have a capacity of 2,000 tons per day. Total cement capacity in Iran for 1987 was about 16 million tpy according to a Government official. Production was reported elsewhere at about 12 million tpy.

Fertilizer Materials.—Plans were reported for using "Esfordi" apatite (a phosphate mineral) to make phosphoric acid for domestic consumption by 1990.

Strontium.—Reported to be one of the largest such deposits in the world, the celestite seam at Nakhjir, about 150 kilometers southeast of Tehran, has been a major source of strontium since 1977. It apparently was discovered (and mining began) in the late 1960's, as an outcrop in a sedimentary-evaporite series in the northwestern part of the Great Salt Desert (Dasht-e-Kavir). Reserves were cited as 1 million tons at 90% $SrSO_4$. Reportedly, the mine-run output was hand sorted to maintain a 90% to 92% $SrSO_4$ product. Production was said to be 20,000 to 25,000 tpy over the last few years, almost all of it going to the U.S.S.R.

Sulfur.—With sulfur production from gas and oil processing claimed to be more than 1 million tpy and domestic consumption

only 200,000 tpy, the Oil Ministry was searching for foreign markets for the surplus. Some was exported by the National Petrochemical Co. Sources of the sulfur were reported to be primarily the Khangiran and Bid Bolan gas refineries and the Razi and Kharg petrochemical plants, with some additional production at the Esfahan, Shiraz, Tabriz, and Tehran oil refineries.

MINERAL FUELS

Coal.—Production, from a large number of mines exploiting the substantial coal reserves, apparently again totaled more than 1 million tons. Normal mine output was hand-selected mineral. About two-thirds came from the central or Kerman Basin area, 40 to 140 kilometers north-northwest of Kerman, and one-third from the northern or Elborz Range area, mostly within 100 kilometers of Shahrud, which is about 300 kilometers east of Tehran. However, the northern area included mines extending to more than 100 kilometers northwest of Tehran, and another group that were 500 kilometers east of Shahrud in the Kopet Dagh Range east of Mashhad. Other known deposits occur as far west as south of Tabriz, as well as about 450 kilometers north of Kerman near Tabas in the center of the Great Deserts.

The largest mine was reported to be in the Kerman Basin. It had a nominal output capacity of 2,000 tons per day; but many of the hundreds of mines were said to have produced less than 100 tons per day. Production was described as primarily from underground hand operations in deposits that generally occurred as a series of highly folded and faulted seams in the Shemshak Formation of the Triassic-Jurassic Age, outcropping in mountainous terrain, dipping more than 20° and less than 1 meter thick. However, the Tabas deposit reportedly dipped less than 20° and was less tectonized and thicker than others. The Tabas area, according to the press, had been explored in detail since 1976 and large new operations were planned to start in 1990, to supply the new Mubarakeh steel complex. However, this is difficult to understand since the design for Mubarakah, as well as for the Ahwaz steel complex being rebuilt, called for natural-gas-fueled DRI plants with electric furnaces, rather than coke/coal consuming blast and reverberatory furnaces as at the Esfahan steel complex. Perhaps the coal will be used to generate electric power at complexes.

A central washery at Zarand served the Kerman mines. At least one washery, at Shahrud, served the north-central mines, according to reports that also stated that relatively small (10 to 27 tons) trucks normally transported the customarily hand-sorted coal from mine to washery and/or railhead. Tabas appeared to require a 500-kilometer truck haul to rail lines.

Most of the coal reportedly was mined by the Government's National Iranian Steel Co. and went to Esfahan for coking. This was said to require adding 10% to 15% high-quality coking coal from Europe and Australia, imported through the Port of Bandar-e 'Abbas and trucked 350 kilometers or more to the railhead at Kerman. Expansion of the Esfahan plant and especially other industrial complexes were cited as the basis for projecting a severalfold increase in national coal demand by 1990.

In a related report, a coal-tar refinery was planned at Esfahan to treat 100,000 tpy of coal residue.

Natural Gas.—Iranian natural gas reserves, nearly 500 trillion cubic feet, were second only to those of the Soviet Union. Even with internal consumption, including oilfield injection, at 1 trillion cubic feet per year and with continued Government efforts to increase usage by major amounts each year, the reserves afforded Iran a wide margin for export. In an effort to diversify revenue sources, the National Iran Gas Co. (NIGC) was considering construction of a natural gas pipeline to Turkey for eventual access to the European markets via Greece and Italy. Natural gas from Iran would be in direct competition with that from the Soviet Union. However, European consumers' interest in diversity of supply may offer Iran an advantage.

Government plans continued to call for substantial increases in production and internal use for oilfield pressurizing, power, and a variety of heating applications. Distribution pipelines were under construction in the north and northwest to supply hundreds of thousands of households and other small consumers as well as industry. Another line was being built in the south from Bandar-e 'Abbas to Sar Cheshmeh, site of Iran's major copper complex designed to use fuel oil normally.

Completion of the $1 billion Vali Asr gas gathering and refining complex at Nar-Kangan on the gulf was imminent at year-end. Initially annual production was anticipated at 450 billion cubic feet, from the Nar Field. It was expected to rise to 1 trillion cubic feet when the Kangan Field is brought on-stream.

The Khangiran gas complex in the northeast was completed in 1984 and designed to

supply gas to the Neka powerplant and neighboring towns. NIGC invited bids to construct two turnkey gas treatment plants for sulfur recovery at Khangiran. Expansion of the complex coincided with the approval of the extension of the gas trunkline from Sarakhs Gasfield to Rasht for supplying the two Azerbaijan Provinces.

Petroleum.—*Exploration.*—Iran entered into a joint exploration agreement with the U.S.S.R. for drilling in the Caspian Sea. An accord was signed in 1987 over previously disputed boundaries, and it included a provision for the use of U.S.S.R. rigs to drill two wells in Iranian waters of the Caspian Sea to explore Tertiary and Mesozoic sediments. An agreement with Turkey to establish a joint drilling company to work in the Caspian Sea was also reported. All Persian Gulf offshore exploration activities were halted as a result of the escalation of the war in the gulf in 1986 and 1987.

Of the 18 rigs involved in onshore operations in Iran at yearend, 2 rigs were assigned to exploration, 7 rigs were engaged in development work in the southwest oilfields, 2 were on oil well workover assignments and the remaining 7 were utilized in gasfields in the Khanigran and Nar-Kangan areas.

The NIOC announced a new recoverable crude oil reserve estimate of 93 billion barrels, nearly double previous estimates. This was apparently in conjunction with or in response to actions by other OPEC members who similarly raised their reserve figures, reportedly based on new standards and/or new interpretations of data. However, a decline in natural reservoir pressure and in exploration investment had been documented, and this would have indicated support for the earlier, smaller figure.

Production.—Crude oil production averaged more than 2.4 million bbl/d in 1987, rebounding from the low 1.6-million-bbl/d levels of September-October of the previous year but still only a fraction of the 6-million-bbl/d peak level in 1974. Iran's 1987 production quotas as set by OPEC were 2.255 million bbl/d for the first half of the year, 2.369 million bbl/d for the third quarter, and 2.612 million bbl/d in the final quarter. Actual production exceeded OPEC quotas by 0.25 million bbl/d in the first half, met quotas in the third quarter, and produced 0.3 million bbl/d under quota in the last quarter. For 1988, the OPEC production quota for Iran was set at 2.369 million bbl/d.

The major oilfields were in southern Iran where the bulk of crude output in 1987 was obtained from onshore fields. This was because of war damage to offshore installations in the north gulf at Ardeshir, Cyrus, and Nowruz and also in the south at Rakhsh, Rostam, and Sassan. Probably less than 250,000 bbl/d came from offshore, mostly from fields in the south gulf. To increase production in the southern Iranian fields, gas injection was found useful and more was planned.

Transportation.—Despite continued air attacks on the major onshore fields at Agha Jari, Ahwaz, Gachsaran, and Marun, as well as on the Ganaveh mainland pumping station for Kharg Island, crude continued to be exported. Tankers shuttled from Kharg Island and nearby loading points to transshipment points outside the normal range of Iraqi warplanes to reduce the vulnerability of foreign ocean tankers. The principal transshipment point was the newest, Larak Island terminal south of Bandar-e 'Abbas. Older terminals at Sirri Island and Lavan Island, respectively, about 100 kilometers and 200 kilometers closer to Kharg, were also used. The National Iranian Tanker Co. operated at least 18 tankers in the shuttle service, adding $0.50 to $0.60 per barrel to the cost of its exports of crude oil. Up to 13 additional tankers were reportedly used as floating terminals at the southern ends of the shuttle.

Iran continued to have under consideration several overland pipeline options to supplement or bypass its traditional export shipping outlets. One option was to supplement the Kharg Island shuttle with slightly less vulnerable facilities about halfway to Larak at Kangan, Taheri, and/or Asaluyeh. Saipem S.p.A. (Italy) undertook construction of a 42-inch pipeline for the initial 100 kilometers between Gurreh, a pipeline junction on the mainland near Kharg Island, and Bushehr. Two Iranian firms, Unigulf and Tehran Jenoub, commenced constructing a 220-kilometer pipeline from Bushehr to Taheri, installing 56-inch pipe that was surplus from an aborted project. Construction of tank farms and single-buoy moorings at Taheri were contracted to the Republic of Korea's Daelim Industrial Co. There was also a proposal to use a portion of the existing IGAT 2 gas pipeline that runs southerly from about 95 kilometers east of the Gachsaran Oilfield northeast of Gurreh, to within about 50 kilometers north of the Port of Kangan, by converting it to handle 1 million bbl/d of oil and adding shorter pipelines at each end. However, all such

proposed supplementary facilities had only limited advantages, because even Larak was bombed by Iraqi warplanes using aerial refueling to extend their striking range.

For better protection of exports, plans for a 700-kilometer extension of the Taheri pipeline southeast to Jask beyond Bandar-e 'Abbas on the Gulf of Oman, but no tenders were reported by yearend. Initial capacity was said to be 500,000 bbl/d. Other schemes studied included: conversion of the idle IGAT 1 gas pipeline to permit 700,000 bbl/d of oil to be pumped north from Agha Jari through the border city of Asfara to the vicinity of Baku in the U.S.S.R. and finally via a connecting Soviet crude pipeline to the Black Sea for export; and construction of a $3 5 billion, 1,900-kilometer, 1-million-bbl/d pipeline from the Khuzestan Oilfields northwesterly to Turkey and on to the Mediterranean Sea near the Port of Iskenderun. The U.S.S.R. scheme was apparently being delayed and the Turkish plan, first discussed 20 years ago, was reported to be still in serious doubt at yearend.

Refining.—Six refineries, Bakhtaran, Esfahan, Lavan, Shiraz, Tabriz, and Tehran were operational during most of 1987 although output may have been as low as 30% of capacity for some of the installations. Only the Tehran refinery operated at approximately 85% of its 232,000-bbl/d capacity. The 280,000-bbl/d-capacity Esfahan refinery, which provided one-third of Iran's product needs, was badly damaged in October. Because war damage had reduced Iran's ability to meet the demand for petroleum products, reliance on imported products had appreciably increased.

Petroleum products obtained through purchases on the spot market and through crude processing deals were estimated at 400,000 bbl/d in 1987. This figure represents about 60% of Iran's petroleum product consumption requirements. Not all of the imported products may have been directly utilized. Stockpiling to assure an uninterrupted supply may have been at least a partial objective because shortages and rationing of petroleum products seriously disrupted the economy.

Product availability should improve when the $1.5 million Bandar-e 'Abbas 220,000-bbl/d-capacity refinery (already under contract to a joint venture of Snamprogetti S.p.A. and Chiyoda Chemical Engineering and Construction Co.) and the first of two 135,000-bbl/d refinery units at Arak are operational. Contract award for the Arak refinery's first unit, which will process light crude from the Ahwaz-Asmari Field, was anticipated in early 1988. The second unit, to process heavy crude from the north Dezful Field, was not yet scheduled. A 70,000-bbl/d-capacity refinery was planned for Taheri, and the Tehran refinery was slated for 100,000-bbl/d-capacity expansion. Mashhad was the possible location of another new refinery, and post war rebuilding of at least a part of the war-destroyed Adaban refinery was not ruled out. These additional refineries and expansion-repair projects would raise Iran's refinery capacity to more than 1 million barrels per day early in the next decade.

Underground tank farms costing $300 million were reportedly planned for refineries at Arak and Bandar-e 'Abbas, presumably for better protection against military attack.

Petrochemicals.—Iran imports about $2 billion in petrochemicals yearly; therefore, the development of a domestic industry has high priority. The National Petrochemical Co. awarded two contracts for the $1.5 billion petrochemical complex at Arak. Technipetrol of Italy was awarded the engineering, field services, and materials contracts for a 60,000-tpy-capacity, linear, low-density polyethylene plant and a 240,000-tpy ethylene unit. Uhde of the Federal Republic of Germany was contracted to provide engineering, field services, and materials for a 60,000-tpy, high-density polyethylene unit.

The Iran-Japan Petrochemical Co.'s $4 billion complex at Bandar Khomeini was 85% completed when it suffered about $500 million in Iraqi war damages in 1985. At that time Japanese technicians withdrew from the site until the cessation of hostilities. The complex sustained further damage during two air attacks in August 1987. The damage was reported to be extensive and may result in abandonment of the project.

A third petrochemical complex was approved in early 1987 for a site near Esfahan; however, by midyear the site location for the $1.5 billion installation was transferred to Tabriz and construction started in December. The complex's annual capacities were planned at 100,000 tons of high-density polyethylene, 40,000 tons of styrene, 60,000 tons of polystyrene, 14,000 tons of SB latex, and 36,000 tons of polyols. Feedstock was not defined, but originally it was to be naphtha from the Esfahan refinery. A simi-

lar-size facility was also being considered for either Esfahan or Bandar-e 'Abbas, where smaller plants were being built. Another small one was under construction at Shiraz.

The existing urea plant at Shiraz, started up in 1986, was to be increased in capacity from 500,000 tpy to 800,000 tpy.

Uranium.—During the year, the press variously reported about 5,000 tons of uranium or uranium deposits situated mostly in Yazd Province. These may be referring to the same deposits that reports in 1984 described as containing more than 5,000 tons of uranium in vein-type mineralization associated with lead-zinc-iron minerals near Saghand, 125 kilometers northeast of Yazd. In 1986, a similar 5,000-ton deposit of high-grade ore near Saghand was reported under development, and an earlier report mentioned a uranium discovery of 5,000 tons made near Saghand in 1981. Uranium exploration in Iran started more than 30 years ago even before French assistance was first provided in the late 1960's. Afterward, other foreign groups (including the United States and the U.S.S.R.) were intermittently involved in exploration. Many occurrences were found from the northwest to the northeast in the Elburz Mountains and extensions, and from the northwest to the southwest in the Zagros Mountains, as well as in the central desert near Saghand. Several deposits were said to have been test-mined, but apparently none were considered appropriate for commercial operations. In more recent years, Iranian geological agencies alone were active in continuing the search.

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[1]Physical scientist, Division of International Minerals.

[2]Values are as quoted by sources of information, unless otherwise indicated. Where necessary, values were converted from Iranian rials (Rls) to U.S. dollars at the rate of Rls71.460=US$1.00, the "Principal Rate/Period Average" for calendar 1987 appearing in International Financial Statistics of the International Monetary Fund. The "principal rate" is the "official rate" and was Rls65.622=US$1.00 at calendar yearend. However, the Government was reported to have also allowed other "preferential" rates such as about Rls500=US$1.00 to exporters of nonoil commodities. "Free Market" rates were reported to range from Rls800=US$1.00 to Rls1,000=US$1.00.

[3]International Petroleum Encyclopedia 1988.

[4]Smith, T. D. Iran. Min. Annu. Rev. 1988, June 1988.

[5]Work cited in footnote 4.

[6]Work cited in footnote 4.

The Mineral Industry of Iraq

By George A. Morgan[1]

In 1987, Iraq's capability to export crude petroleum, the country's main source of revenue, was put to a severe test as the war with Iran widened. Crude petroleum prices increased, and export sales were estimated to be $11 billion[2] compared with $7.5 billion in 1986. Petroleum exports accounted for more than 95% of total exports and about 60% of the gross national product. Austerity programs, cuts in the expatriate labor force, reduced imports, and debt rescheduling helped stabilize the overall economy. Exploration by the Geological Survey and Mineral Investigations Department has resulted in the discovery of an estimated 210 million tons of kaolin and additional resources of bentonite and limestone.

Iraq rescheduled $500 million in loan payments due European creditors. Payments were deferred for 3 years, and the Rafidain Bank of Iraq had only to pay a negotiation fee plus 1% per year in interest and service charges.

PRODUCTION AND TRADE

India continued to increase Iraqi crude oil purchases, estimated to reach 26 million barrels in the year ending March 1988. India accepted payment in crude petroleum for services performed on operations and maintenance contracts in other industries, such as with various cement companies.

Shipments of crude petroleum by Saudi Arabia and Kuwait on behalf of Iraq were maintained and were to continue in 1988, with repayment to be made in kind at the end of the war. Kuwait supplied 125,000 barrels per day (bbl/d) from the Khafji Field while Saudi Arabia supplied 125,000 bbl/d from the Khafji Field and 60,000 bbl/d of light crude.

A 5-year trade agreement was signed between the United States and Iraq, extendable automatically for additional 5-year terms. U.S. exports to Iraq have been primarily foodstuffs; the agreement also facilitates the sale of electronics equipment and machinery. U.S. exports to Iraq were estimated at $700 million compared with $528 million in 1986. U.S. imports from Iraq were about $500 million.

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

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS					
Cement, hydraulic[e] thousand metric tons	5,600	8,000	8,000	8,000	10,000
Gypsum[e] do.	170	300	300	300	350
Nitrogen:[e]					
N content of ammonia do.	80	80	60	60	60
N content of urea do.	50	60	60	60	60
Phosphate rock[e] do.	[3]1,199	1,000	1,000	1,000	1,000
Salt[e] do.	80	80	70	70	70
Sulfur, elemental:[e]					
Native, Frasch do.	300	500	500	600	620
Byproduct do.	40	70	70	200	250
Total do.	340	570	570	800	870
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural:[e]					
Gross million cubic feet	400,000	400,000	450,000	450,000	500,000
Marketed[4] do.	60,000	60,000	80,000	80,000	100,000
Natural gas liquids:[e]					
Natural gasoline thousand 42-gallon barrels	400	400	400	400	400
Propane and butane do.	1,000	1,000	1,000	1,000	1,000
Petroleum:					
Crude do.	400,000	437,800	520,900	617,000	765,000
Refinery products[e] do.	100,000	110,000	110,000	110,000	110,000

[e]Estimated. [p]Preliminary.
[1]Includes data available through May 11, 1988.
[2]In addition to the commodities listed, lime and a variety of crude construction materials (clays, sand and gravel, and stone) are also produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.
[3]Reported figure.
[4]Includes reinjected, if any.

COMMODITY REVIEW

METALS

Iraq's iron and steel plant at Khor al Zubair, one of the first in the region to use modern direct-reduction technology, has remained inoperative since September 1980 owing to the war with Iran. The plant had two direct-reduction furnaces that would use imported iron ore. Steel output was based on an 80% sponge iron and 20% steel scrap feed to four electric arc furnaces. Capacity was about 400,000 tons per year.

INDUSTRIAL MINERALS

Cement.—The Iraq State Cement Enterprise concluded an agreement to supply Kuwait with most of its white cement requirements. Contracts for sales of white cement and portland cement also were signed with Jordan and Egypt. Reportedly, about 6.5 million tons of the 10 million tons produced annually were exported.

Phosphate.—Phosphate resources estimated at 2.5 billion tons were discovered at Marbat, near Akashat in northwestern Iraq. Total resources for the country were estimated at 7.5 billion tons, including those at Akashat and at an unidentified deposit. Discovery was by the Geological Survey and Mineral Investigations Department.

Sulfur.—Exports were nearly 500,000 tons, valued at about $50 million. Trial production commenced at a new, $55 million sulfur-recovery plant at Mishraq. Feed material to the plant was cake and foam from waste piles accumulated over a 15-year period. Throughput was 600 tons per day with a recovery rate of about 90%. Annual production was expected to be 152,000 tons of sulfur and 60,000 tons of sulfuric acid. Sulfur in solid form was exported on short-term contracts to Bangladesh, Bulgaria, China, Egypt, Indonesia, Italy, Lebanon, Saudi Arabia, and Tunisia. Consumption at the Akashat phosphate fertilizer complex has been as high as 500,000 tons per year. Sulfur reserves were 515 million tons.

MINERAL FUELS

Natural Gas.—Most natural gas produced was associated with crude petroleum. Natural gas utilization amounted to 65%, following a series of development projects, one of which included the export of 300 million cubic feet per day to Kuwait.

The Government was interested in a

number of schemes for the underground storage of gas and liquefied petroleum gas (LPG), such as in salt cavities, rock caverns, and aquifers, on the basis of economic, environmental, strategic, and security reasons. A French company completed phase 1 of a plan to store up to 5 billion cubic meters of LPG in aquifers in the Ratawi structure. Dry gas would be reinjected to recover the LPG. Gas was being stored in the north of the country, and a plan for storage of 1 billion cubic meters of LPG in salt caverns near Kirkuk was completed. A pilot plant was also started in northern Iraq for storage of propane and butane.

Domestic consumption of butane was 732,773 tons in 1986, the latest year available, compared with 390,000 tons in 1979 when the war with Iran commenced. The butane replaced kerosene for household consumption.

Petroleum.—*Production.* — Production was 2,095,800 bbl/d, and confirmed oil reserves were 72 billion barrels with an additional 40 billion barrels inferred. The Government confirmed the existence of four new oilfields, including the Saddam Field between Tikrit and Kirkuk, and the Himreen Field near the border with Iran.

The General Oil Pipelines Agency of the Ministry of Oil was involved in the planning and construction of pipelines to major towns in the country. Included in the projects was construction of a gas pipeline from the northern dry gasfields to the south. The first stage was due for completion in mid-1988 by Tsvetmetpormexport of the U.S.S.R., which had under way a 345-kilometer, 48-inch pipeline between Nasiriya and Baghdad.

An earlier proposal for a 70,000-bbl/d pipeline from northern Iraq to the Batman refinery in Turkey was upgraded to 300,000 bbl/d. The line would extend from Kirkuk across about 400 kilometers of difficult terrain and take a year to complete. Crude petroleum was currently being trucked to the Batman refinery at the rate of 25,000 bbl/d.

A second crude oil pipeline across Turkey was commissioned July 27, and had a capacity of 500,000 bbl/d, bringing total exports through Turkey to about 1.5 million bbl/d. Total petroleum exports at midyear were 2 million bbl/d, including 500,000 bbl/d through the Iraq Pipeline Trans Saudi Arabia 1 (IPSA-1) pipeline. Completion of the second pipeline across Turkey included construction of five pumping stations, five 850,000-barrel storage tanks at Yumurtalik and six 400,000-barrel storage tanks at Kirkuk. Construction of a second line across Saudi Arabia would bring exports close to the prewar level of 3.2 million bbl/d and was scheduled for completion by September 1989.

Planning was under way for development of the West Qurna Oilfield, including refining and distribution schemes. The main contractor was Technoexport of the U.S.S.R., which proposed degassing and pumping stations, and pipelines. Initial output from the field would be 200,000 bbl/d; later additions to capacity would increase this to 600,000 bbl/d.

Consortiums from France, Italy, Japan, and the Republic of Korea won contracts for construction of the IPSA-2, an 800-kilometer project. Total cost of IPSA-2 was about $1.5 billion, of which 90% was to be repaid to the contractors as crude petroleum at the rate of 100,000 bbl/d. The remaining 10% of the cost was a cash advance. Total construction time was estimated at 2 years from commencement of work in December 1987.

Refining.—Total refining capacity from seven refineries in 1987 was 318,500 bbl/d, and catalytic reforming capacity was 43,500 bbl/d.

A 250,000-ton-per-year lubricant plant was inaugurated at Baiji, northwest of Baghdad. Output was mainly for export; with about 50,000 tons used locally.

[1]Physical scientist, Division of International Minerals.
[2]Where necessary, values have been converted from Iraqi dinars (ID) to U.S. dollars at the rate of ID0.31 = US$1.00.

The Mineral Industry of Ireland

By Richard H. Singleton[1]

Ireland continued to be a significant producer and exporter of alumina and of lead and zinc concentrates. Mined peat and extracted offshore natural gas, Ireland's largest and second largest mineral commodities, respectively, accounted for 27% of domestic energy consumption and 38% of the country's electrical power production. The remainder of domestic energy requirements were supplied by imported oil and coal, in order of value. Output of alumina, peat, and steel increased while production of aggregates and lime decreased. Activity in minerals exploration for offshore oil as well as onshore metallic ores and industrial minerals increased.

It was estimated that the minerals industry accounted for approximately 5% of Ireland's gross national product (GNP). An approximate breakdown by value of the $1.5 billion[2] minerals industry is mineral fuels, 60%; metals mining and refining, 25%; and industrial minerals, 15%. Peat accounted for about 70% of mineral fuels production with the balance being nearly all offshore natural gas. Alumina production comprised about 50% of the value of the metals industry, followed by crude steel, 30%, and zinc concentrate, 15%. Minerals for the construction industry accounted for about 80% of the value of industrial minerals and, of this, cement and aggregates each accounted for about one-third.

The Irish economy showed several strong features after many years of slow growth. The real GNP increased 4% more than that of 1986 to $26 billion caused largely by strong exports, which increased 20% more than that of 1986 to $16 billion. The trade balance reached a record-high surplus of $2 billion. The current balance of payments moved into surplus for the first time since 1967, and inflation increased 3%, the lowest percentage rise in 20 years. Unemployment, however, remained high at about 19%. Government expenditure reductions, applied to reduce continuing high public sector borrowing, restricted construction activity by about 6% below that of 1986, which in turn decreased domestic demand for steel and industrial minerals. The appreciating Irish pound against the U.S. dollar reduced earnings from exported mineral products denominated in U.S. dollars.

PRODUCTION

Peat mining, Ireland's largest industry, increased for the third consecutive year reaching early 1980's levels but remained much below the 1984 peak. Alumina production, the country's third largest industry, also increased significantly as the alumina plant reached full capacity. Steel output from the scrap-fed steel miniplant, Ireland's only producer, continued to increase as it had throughout the 1980's. Production of aggregate materials and lime decreased as a result of decreased construction activity.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS					
Alumina thousand tons	66	653	555	686	778
Iron and steel: Steel, crude do	141	166	203	208	220
Lead:					
Mine output, Pb content	33,600	37,200	34,600	36,400	33,800
Metal, refined, secondary	8,000	9,100	9,000	10,200	9,600
Silver, mine output, Ag content thousand troy ounces	319	279	276	262	231
Zinc, mine output, Zn content	185,900	205,900	191,600	181,700	177,000
INDUSTRIAL MINERALS[2]					
Barite thousand tons	199	220	214	128	70
Cement, hydraulic do	1,486	1,377	1,457	1,398	1,448
Gypsum do	352	325	304	289	284
Lime	[e]50,000	67,900	84,800	87,600	77,000
Magnesia[3] [e] thousand tons	[4]65	75	75	[r]65	70
Nitrogen: N content of ammonia do	294	371	338	355	[e]360
Sand and gravel[5] do	[e]6,500	6,714	6,749	6,550	5,564
Stone and other quarry products:					
Limestone[5] do	[e]11,000	10,598	9,337	7,865	6,970
Other[5] [6] do	[e]3,000	2,665	2,411	2,041	1,953
MINERAL FUELS AND RELATED MATERIALS					
Coal: Anthracite and bituminous do	75	70	57	54	45
Gas, natural: Marketed million cubic feet	77,500	82,200	85,200	59,300	58,900
Peat:					
For agricultural use thousand tons	[e]95	96	96	97	81
For fuel use:					
Sod peat[7] do	[e]1,650	1,643	1,107	1,185	363
Milled peat[8] do	[e]5,000	6,291	1,521	3,864	5,309
Total do	[e]6,650	7,934	2,628	5,049	5,672
Peat briquets do	[e]400	410	486	473	499
Petroleum refinery products:					
Gasoline, motor thousand 42-gallon barrels	2,669	2,610	2,694	2,762	2,528
Distillate fuel oil do	2,812	3,120	3,255	3,788	3,945
Residual fuel oil do	2,828	2,886	3,166	3,744	3,556
Liquefied petroleum gas do	209	162	186	302	255
Naphtha do	45	99	126	378	387
Refinery fuel and losses do	276	659	[r]365	685	390
Total do	8,839	9,536	[r]9,792	11,659	1,061

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

[1]Table includes data available through Aug. 31, 1988.

[2]Ireland also produces significant quantities of synthetic diamond and is the major overseas supplier of this material to the United States; however, output is not reported, and available information is inadequate to make reliable estimates of output levels.

[3]Based on exports.

[4]Reported figure.

[5]Excludes output by local authorities and road contractors.

[6]Includes clays for cement production, fire clay, granite, marble, rock sand, silica rock, and slate.

[7]Includes production by farmers and by Bord Na Mona.

[8]Includes milled peat used for briquet production.

TRADE

The positive trade balance for merchandise tripled to a record $2 billion as exports increased more than imports. Exports to the United States increased 40% to $1.1 billion; however, U.S. exports to Ireland increased even more and the negative trade balance with the United States increased to $1.2 billion. U.S. exports of coal to Ireland, valued at $63 million, supplied about 50% of the country's coal requirements.

Approximately 30% of Ireland's minerals production was exported; of this, about 80% was ores and metals including essentially all of the alumina and zinc, lead and silver concentrates, in order of value, and 80% of the steel. About the same amount of steel was imported, but in different shapes than those that were exported. About 25% of industrial minerals production was exported, notably all of the magnesia and minor amounts of cement, ammonia, and gypsum, in order of exported value. No natural gas and only about 4% of peat production was exported.

Table 2.—Ireland: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	--	21	--	All to United Kingdom.
Alkaline-earth metals	--	1	--	Do.
Aluminum:				
Oxides and hydroxides	571,986	669,362	75	United Kingdom 262,971; Norway 135,108; West Germany 131,208.
Metal including alloys:				
Scrap	5,190	8,093	(2)	United Kingdom 4,245; West Germany 1,384; Japan 632.
Unwrought	585	1,478	4	United Kingdom 1,309; Belgium-Luxembourg 75; Netherlands 74.
Semimanufactures	2,483	2,070	28	United Kingdom 1,194; France 183; West Germany 125.
Arsenic: Oxides and acids	(2)	--		
Beryllium: Metal including alloys, all forms	--	(2)	--	All to United Kingdom.
Chromium:				
Oxides and hydroxides	--	20	--	Do.
Metal including alloys, all forms	(2)	(2)	--	All to Denmark.
Cobalt: Metal including alloys, all forms	32	73	41	Belgium-Luxembourg 20; United Kingdom 10.
Columbium and tantalum: Metal including alloys, all forms, tantalum	1	3	--	All to United Kingdom.
Copper:				
Matte and speiss including cement copper	--	17	--	All to Netherlands.
Oxides and hydroxides	--	5	--	All to United Kingdom.
Sulfate	27	24	--	Do.
Ash and residue containing copper	404	172	--	All to Belgium-Luxembourg.
Metal including alloys:				
Scrap	6,928	6,312	--	Belgium-Luxembourg 2,905; United Kingdom 1,016; Netherlands 1,008.
Unwrought	1,062	825	8	Netherlands 295; West Germany 280; United Kingdom 123.
Semimanufactures	1,513	1,862	493	United Kingdom 668; Netherlands 311.
Gold:				
Waste and sweepings value, thousands	$1,035	$991	--	United Kingdom $704; West Germany $287.
Metal including alloys, unwrought and partly wrought do.	$1,091	$1	--	All to United Kingdom.
Iron and steel: Metal:				
Scrap	50,045	40,751	11	United Kingdom 36,520; West Germany 1,822; Belgium-Luxembourg 1,129.
Pig iron, cast iron, related materials	60	81	--	United Kingdom 59; Switzerland 10; West Germany 5.
Ferroalloys:				
Ferrochromium	--	(2)	--	All to United Kingdom.
Ferromanganese	110	29	--	All to Belgium-Luxembourg.
Ferromolybdenum	--	2	--	All to United Kingdom.
Silicon metal	1	7	--	United Kingdom 6; Libya 1.
Unspecified	4	--		
Steel, primary forms	183	20	--	United Kingdom 18; Netherlands 1; Sweden 1.
Semimanufactures:				
Bars, rods, angles, shapes, sections	170,828	179,847	14	United Kingdom 57,858; West Germany 40,937; Netherlands 34,073.
Universals, plates, sheets	8,907	5,280	(2)	United Kingdom 5,124; West Germany 109; Netherlands 23.
Hoop and strip	777	579	--	United Kingdom 470; Italy 68; West Germany 41.
Rails and accessories	478	228	--	United Kingdom 208; Netherlands 19.
Wire	1,149	1,187	3	United Kingdom 1,118; France 31; Italy 29.
Tubes, pipes, fittings	4,771	3,957	53	United Kingdom 3,528; West Germany 273.
Castings and forgings, rough	197	207	1	Papua New Guinea 138; United Kingdom 58; Egypt 7.

See footnotes at end of table.

Table 2.—Ireland: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Lead:				
Ore and concentrate	62,622	60,400	--	France 19,700; West Germany 13,560; Brazil 11,037.
Ash and residue containing lead	199	58	--	India 37; United Kingdom 21.
Metal including alloys:				
Scrap	4,085	2,062	--	Belgium-Luxembourg 1,272; Netherlands 398; United Kingdom 300.
Unwrought	132	14	--	United Kingdom 13.
Semimanufactures	4,235	5,303	--	United Kingdom 5,030; Malaysia 121; Singapore 114.
Lithium: Metal including alloys, all forms	--	(2)	--	All to United Kingdom.
Magnesium: Metal including alloys:				
Scrap	7	10	--	All to West Germany.
Unwrought	--	4	--	All to United Kingdom.
Semimanufactures	18	4	--	United Kingdom 3; Singapore 1.
Manganese: Oxides	2	46	--	All to United Kingdom.
Molybdenum:				
Ore and concentrate	1	--		
Metal including alloys:				
Unwrought	--	3	--	Do.
Semimanufactures	(2)	(2)	--	Do.
Nickel:				
Matte and speiss	1	--		
Metal including alloys:				
Scrap	151	161	16	United Kingdom 115; West Germany 30.
Unwrought	36	35	4	United Kingdom 30; Brazil 1.
Semimanufactures	216	244	--	Switzerland 82; West Germany 71; France 44.
Platinum-group metals:				
Waste and sweepings value, thousands	$1	$14	--	Italy $8; United Kingdom $6.
Metals including alloys, unwrought and partly wrought troy ounces	13,311	19,741	--	United Kingdom 19,709; West Germany 32.
Silver:				
Waste and sweepings value, thousands	$712	$1,022	$15	West Germany $517; United Kingdom $471.
Metal including alloys, unwrought and partly wrought thousand troy ounces	36	3,215	--	Mainly to United Kingdom.
Tin:				
Oxides	--	795	--	All to United Kingdom.
Metal including alloys:				
Scrap	1,366	1,416	--	United Kingdom 1,276; Belgium-Luxembourg 104; Netherlands 20.
Unwrought	11	64	--	Belgium-Luxembourg 63.
Semimanufactures	108	117	--	United Kingdom 111; Switzerland 5.
Titanium:				
Oxides	--	7	--	United Kingdom 5; West Germany 2.
Metal including alloys, semimanufactures	45	12	--	Netherlands 9; United Kingdom 3.
Tungsten: Metal including alloys:				
Unwrought	--	3	--	All to United Kingdom.
Semimanufactures	1	1	--	Mainly to United Kingdom.
Zinc:				
Ore and concentrate	370,754	368,974	--	Belgium-Luxembourg 125,871; Italy 114,126; France 44,099.
Oxides	34	88	9	West Germany 41; United Kingdom 24; Netherlands 13.
Ash and residue containing zinc	114	142	--	All to West Germany.
Metal including alloys:				
Scrap	309	168	--	Spain 84; United Kingdom 84.
Unwrought	56	123	--	United Kingdom 118; Netherlands 5.
Semimanufactures	91	90	43	United Kingdom 30; Italy 8.
Zirconium: Metal including alloys, semimanufactures	(2)	--		
Other:				
Oxides and hydroxides	1	46	--	United Kingdom 40; Spain 5.
Ashes and residues	55	--		

See footnotes at end of table.

Table 2.—Ireland: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	23	11	--	All to United Kingdom.
Artificial:				
Corundum	--	1	--	All to Chile.
Silicon carbide	281	3	--	All to France.
Dust and powder of precious and semi-precious stones including diamond kilograms	6,531	19,982	15,970	Japan 1,727; West Germany 843.
Grinding and polishing wheels and stones	56	72	17	United Kingdom 42; Sinapore 6.
Asbestos, crude	151	179	--	All to United Kingdom.
Barite and witherite	198,933	121,585	11,550	United Kingdom 33,305; Kuwait 21,250; Norway 16,900.
Boron materials: Elemental	--	2	--	All to United Kingdom.
Bromine	1	(2)	--	Do.
Cement	259,315	254,898	--	United Kingdom 148,867; Norway 105,279; Netherlands 40.
Clays, crude:				
Bentonite	483	102	--	United Kingdom 20; Italy 2; unspecified 80.
Kaolin	--	1	--	All to Switzerland.
Unspecified	57	46	--	United Kingdom 43; Sweden 3.
Diamond: Industrial stones value, thousands	$392	--	--	
Feldspar, fluorspar, related materials	--	72	--	All to United Kingdom.
Fertilizer materials:				
Crude, n.e.s	2,735	2,428	--	Do.
Manufactured:				
Ammonia	115,813	100,992	--	Spain 41,334; United Kingdom 35,666; Belgium-Luxembourg 15,998.
Nitrogenous	86,119	97,284	--	United Kingdom 53,141; West Germany 24,701; Netherlands 10,766.
Phosphatic	780	10	--	All to United Kingdom.
Potassic	--	2,419	--	Belgium-Luxembourg 1,501; United Kingdom 918.
Unspecified and mixed	55,472	57,969	--	United Kingdom 57,929; France 20; Netherlands 19.
Graphite, natural	--	19	--	All to United Kingdom.
Gypsum and plaster	62,623	56,196	5	United Kingdom 56,186; Netherlands Antilles 4.
Iodine	16	15	--	France 8; United Kingdom 5; Denmark 2.
Lime	5,101	6,884	--	United Kingdom 6,864; Denmark 20.
Magnesium compounds:				
Magnesite, crude	10	--	--	
Oxides and hydroxides	3,591	1,200	--	United Kingdom 1,120; West Germany 79; Japan 1.
Mica: Crude including splittings and waste	6	--	--	
Phosphates, crude	419	992	--	All to United Kingdom.
Phosphorus, elemental	--	1	--	Do.
Pigments, mineral: Iron oxides and hydroxides, processed	--	21	--	West Germany 12; United Kingdom 6; Italy 3.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$94	$199	--	Switzerland $118; West Germany $51; Greece $30.
Synthetic do.	$92	$4	--	United Kingdom $3.
Salt and brine	973	1,556	--	All to United Kingdom.
Sodium compounds, n.e.s.: Carbonate, manufactured	106	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	1,169	1,396	43	United Kingdom 1,110; Netherlands 194.
Worked	8,303	4,287	1,583	United Kingdom 1,816; Australia 393.
Gravel and crushed rock	463,747	388,510	--	United Kingdom 288,581; West Germany 99,869; Netherlands 42.
Limestone other than dimension	98	103	--	All to United Kingdom.
Quartz and quartzite	138	926	(2)	United Kingdom 885; Netherlands 38; Switzerland 2.
Sand other than metal-bearing	2,905	1,574	1	United Kingdom 1,573.

See footnotes at end of table.

Table 2.—Ireland: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur: Sulfuric acid	488	505	--	All to United Kingdom.
Talc, steatite, soapstone, pyrophyllite	1	134	--	Do.
Other:				
Crude	111	277	--	United Kingdom 274; Israel 2.
Slag and dross, not metal-bearing	370	779	--	All to United Kingdom.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	17	19	--	Do.
Carbon black	530	549	7	Netherlands 532; Denmark 5.
Coal:				
Anthracite	6,699	1,543	--	All to United Kingdom.
Bituminous	9,938	10,817	--	Do.
Lignite including briquets	190	55	--	Do.
Coke and semicoke	22	--		
Gas, manufactured	217	36	NA	NA.
Gas, natural: Gaseous million cubic feet	1	1	--	Mainly to United Kingdom.
Peat including briquets and litter	239,877	243,658	76	United Kingdom 210,444; France 20,030; Egypt 5,555.
Petroleum:				
Crude 42-gallon barrels	755,742	--		
Refinery products:				
Liquefied petroleum gas do	86,884	101,361	--	All to United Kingdom.
Gasoline do	106,055	475,966	--	Netherlands 243,908; United Kingdom 231,999.
Mineral jelly and wax do	1,283	999	--	Netherlands 693; Australia 102.
Kerosene and jet fuel do	93	20,499	--	United Kingdom 20,390.
Distillate fuel oil do	67	306,710	--	Netherlands 158,570; France 143,918.
Lubricants do	13,538	24,087	56	United Kingdom 21,826; Netherlands 658; France 518.
Residual fuel oil do	3,234,576	3,979,370	--	United Kingdom 3,281,269; Belgium-Luxembourg 407,492; Netherlands 143,936.
Bitumen and other residues do	1,145	5,812	--	All to United Kingdom.
Bituminous mixtures do	285	509	--	Do.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	1	6	--	United Kingdom 4; West Germany 2.
Alkaline-earth metals	6	--		
Aluminum:				
Ore and concentrate	1,322,262	1,079,908	--	Guinea 970,395; Ghana 76,411; Malaysia 29,398.
Oxides and hydroxides	4,684	4,415	459	United Kingdom 2,951; Netherlands 419.
Ash and residue containing aluminum	10	12	--	All from United Kingdom.
Metal including alloys:				
Scrap	457	513	--	United Kingdom 225; Hungary 217; Belgium-Luxembourg 53.
Unwrought	2,597	3,789	--	Norway 1,100; United Kingdom 1,079; Yugoslavia 1,000.
Semimanufactures	31,662	36,202	523	United Kingdom 19,884; West Germany 4,610; France 3,414.
Antimony:				
Ore and concentrate	--	76	76	
Oxides	--	51	2	United Kingdom 43; Belgium-Luxembourg 3; West Germany 3.
Metal including alloys, all forms	--	2	--	All from United Kingdom.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Arsenic: Oxides and acids	--	15	--	All from United Kingdom.
Beryllium: Metal including alloys, all forms	(2)	(2)	(2)	
Bismuth: Metal including alloys, all forms	(2)	--		
Chromium:				
Ore and concentrate	11	29	--	All from Netherlands.
Oxides and hydroxides	115	129	--	United Kingdom 69; West Germany 59; France 1.
Metal including alloys, all forms	34	19	1	United Kingdom 17.
Cobalt:				
Oxides and hydroxides	21	9	7	United Kingdom 2.
Metal including alloys, all forms	65	117	113	United Kingdom 3; West Germany 1.
Columbium and tantalum: Metal including alloys all forms:				
Columbium (niobium)	(2)	--		
Tantalum	10	1	(2)	Mainly from United Kingdom.
Copper:				
Ore and concentrate	81	(2)	--	All from United Kingdom.
Oxides and hydroxides	--	(2)	(2)	
Sulfate	1,642	1,130	1	U.S.S.R. 734; Belgium-Luxembourg 195; Spain 66.
Ash and residue containing copper	664	215	--	Netherlands 172; Belgium-Luxembourg 43.
Metal including alloys:				
Scrap	380	152	--	Belgium-Luxembourg 85; United Kingdom 67.
Unwrought	246	179	--	United Kingdom 110; West Germany 44; Finland 18.
Semimanufactures	22,946	23,589	163	United Kingdom 9,155; Sweden 4,863; Belgium-Luxembourg 3,017.
Germanium: Metal including alloys, all forms	--	1	1	
Gold:				
Waste and sweepings value, thousands	$64	$1	--	All from United Kingdom.
Metal including alloys, unwrought and partly wrought do.	$6,114	$6,278	$5	United Kingdom $3,902; Sweden $986; Japan $643.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	17	80	--	Netherlands 58; Belgium-Luxembourg 22.
Pyrite, roasted	--	629	--	All from Belgium-Luxembourg.
Metal:				
Scrap	135,912	121,979	--	United Kingdom 120,944; West Germany 19; unspecified 1,015.
Pig iron, cast iron, related materials	1,462	1,716	3	United Kingdom 1,574; Sweden 54; Netherlands 50.
Ferroalloys:				
Ferrochromium	24	9	--	All from Sweden.
Ferromanganese	123	286	--	Portugal 120; West Germany 86; France 80.
Ferromolybdenum	22	2	--	All from United Kingdom.
Ferrosilicomanganese	1,220	1,587	--	Portugal 750; Norway 600; United Kingdom 237.
Ferrosilicon	1,227	1,049	--	Portugal 550; United Kingdom 316; Norway 100.
Silicon metal	186	265	(2)	United Kingdom 136; France 90; Italy 36.
Unspecified	47	51	--	United Kingdom 31; West Germany 20.
Steel, primary forms	3,145	2,725	1	United Kingdom 1,598; France 424; West Germany 415.
Semimanufactures:				
Bars, rods, angles, shapes, sections	118,245	106,198	92	United Kingdom 62,896; Spain 10,778; France 4,838.
Universals, plates, sheets	138,707	125,483	27	United Kingdom 74,128; Finland 7,984; France 7,796.
Hoop and strip	19,948	20,073	1	United Kingdom 15,621; West Germany 2,803; Spain 764.
Rails and accessories	6,775	6,519	(2)	United Kingdom 6,140; West Germany 301; Sweden 46.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures —Continued				
Wire	20,794	18,711	40	United Kingdom 6,543; Belgium-Luxembourg 4,370; France 3,762.
Tubes, pipes, fittings	57,453	50,548	71	United Kingdom 23,411; Belgium-Luxembourg 3,890; Netherlands 3,554.
Castings and forgings, rough	2,737	2,803	73	West Germany 699; France 620; United Kingdom 620.
Lead:				
Ore and concentrate	(2)	--		
Oxides	2,327	95,143	754	United Kingdom 68,101; Netherlands 15,122; East Germany 7,538.
Ash and residue containing lead	20	--		
Metal including alloys:				
Scrap	4,787	7,359	1,660	United Kingdom 5,092; Canada 257.
Unwrought	257	1,251	--	All from United Kingdom.
Semimanufactures	363	411	11	United Kingdom 331; West Germany 47.
Lithium:				
Oxides and hydroxides	(2)	20	--	All from West Germany.
Metal including alloys, all forms	--	(2)	--	Mainly from United Kingdom.
Magnesium: Metal including alloys:				
Unwrought	17	75	--	All from Norway.
Semimanufactures	217	186	21	United Kingdom 115; Norway 31.
Manganese:				
Ore and concentrate metallurgical-grade	24,178	34,758	1	Ghana 34,247; Brazil 306; Netherlands 188.
Oxides	288	219	2	Belgium-Luxembourg 102; United Kingdom 95; Netherlands 20.
Mercury 76-pound flasks	577	551	NA	West Germany 489; United Kingdom 54.
Molybdenum:				
Ore and concentrate	(2)	--		
Metal including alloys:				
Unwrought	--	1	--	Mainly from United Kingdom.
Semimanufactures	4	1	1	
Nickel:				
Ore and concentrate	13	5	--	All from Australia.
Matte and speiss	1	--		
Oxides and hydroxides	11	3	3	
Metal including alloys:				
Scrap	19	13	--	All from United Kingdom.
Unwrought	305	585	(2)	United Kingdom 415; U.S.S.R. 153; Zimbabwe 9.
Semimanufactures	401	458	136	West Germany 181; United Kingdom 87.
Platinum-group metals: Metals including alloys, unwrought and partly wrought troy ounces	11,253	20,995	5,562	United Kingdom 14,050.
Rare-earth metals including alloys, all forms	21	18	--	All from United Kingdom.
Selenium, elemental	1	--		
Silicon, high-purity	25	16	--	United Kingdom 15; West Germany 1.
Silver:				
Ore and concentrate value, thousands	--	$1	--	All from United Kingdom.
Metal including alloys, unwrought and partly wrought troy ounces	825,798	593,314	139,632	United Kingdom 326,043; West Germany 64,302.
Tellurium, elemental and arsenic	16	10	--	All from United Kingdom.
Tin:				
Oxides	1	22	--	Do.
Metal including alloys:				
Scrap	(2)	--		
Unwrought	7	60	--	Do.
Semimanufactures	366	504	(2)	United Kingdom 462; West Germany 21; Netherlands 12.
Titanium:				
Ore and concentrate	432	196	158	Netherlands 20; United Kingdom 18.
Oxides	3,071	3,300	3	United Kingdom 1,996; West Germany 598; France 21.
Metal including alloys, semimanufactures	73	74	36	West Germany 34; United Kingdom 2.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Tungsten: Metal including alloys:				
Scrap	(2)	--		
Unwrought	(2)	3	3	
Semimanufactures	12	13	7	United Kingdom 5.
Uranium and/or thorium:				
Ore and concentrate	19	--		
Metal including alloys, all forms, thorium	(2)	(2)	--	All from Switzerland.
Vanadium: Oxides and hydroxides	--	3	(2)	Mainly from United Kingdom.
Zinc:				
Ore and concentrate	1	1	--	All from United Kingdom.
Oxides	936	1,248	102	United Kingdom 997; West Germany 112.
Blue powder	17	21	--	All from United Kingdom.
Ash and residue containing zinc	54	18	--	All from West Germany.
Metal including alloys:				
Scrap	152	57	--	United Kingdom 56; Sweden 1.
Unwrought	1,298	1,359	--	United Kingdom 867; Netherlands 342; Belgium-Luxembourg 79.
Semimanufactures	489	1,810	1	Netherlands 1,152; United Kingdom 466; Italy 38.
Zirconium:				
Ore and concentrate	5	42	36	United Kingdom 6.
Metal including alloys, semimanufactures	12	3	2	United Kingdom 1.
Other:				
Ores and concentrates	605	3,042	--	Republic of South Africa 2,951; United Kingdom 71; Netherlands 20.
Oxides and hydroxides	33	94	29	United Kingdom 63; Netherlands 1.
Ashes and residues	54	22	--	All from United Kingdom.
Base metals including alloys, all forms	4	--		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	156	299	(2)	United Kingdom 256; Italy 34; Austria 4.
Artificial:				
Corundum	153	77	--	West Germany 38; United Kingdom 34; Netherlands 5.
Silicon carbide	36	24	1	United Kingdom 12; West Germany 9; Norway 2.
Dust and powder of precious and semiprecious stones including diamond ------ kilograms	3,165	1,739	1,686	United Kingdom 43; Sweden 36.
Grinding and polishing wheels and stones	587	1,172	13	United Kingdom 799; West Germany 130; Belgium-Luxembourg 115.
Asbestos, crude	5,244	5,546	--	Canada 2,606; Zimbabwe 1,597; Cyprus 640.
Barite and witherite	391	875	--	United Kingdom 812; West Germany 60; Sweden 2.
Boron materials:				
Crude natural borates	364	503	--	Belgium-Luxembourg 313; Netherlands 190.
Oxides and acids	114	151	(2)	France 150; West Germany 1.
Bromine	47	49	--	All from United Kingdom.
Cement	101,981	81,285	(2)	United Kingdom 46,855; Spain 10,469; East Germany 8,674.
Chalk	3,897	4,579	(2)	United Kingdom 4,462; Belgium-Luxembourg 79; West Germany 32.
Clays, crude:				
Bentonite	1,507	1,281	1	United Kingdom 1,234; Netherlands 10; unspecified 36.
Chamotte earth	5,796	4,380	--	All from Spain.
Fuller's earth	114	233	--	All from United Kingdom.
Kaolin	5,973	8,546	21	United Kingdom 8,410; Belgium-Luxembourg 79; Spain 36.
Unspecified	10,357	12,007	1,043	United Kingdom 10,599; France 304.
Cryolite and chiolite	--	2	--	All from United Kingdom.
Diamond:				
Gem, not set or strung value, thousands	$954	$1,194	--	United Kingdom $629; Belgium-Luxembourg $499; Republic of South Africa $51.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Diamond —Continued				
Industrial stones				
value, thousand	$81	$23	--	United Kingdom $20; Belgium-Luxembourg $3
Diatomite and other infusorial earth	364	146	93	Belgium-Luxembourg 34; United Kingdom 18.
Feldspar, fluorspar, related materials:				
Feldspar	101	52	--	All from United Kingdom.
Fluorspar	43	43	--	Do.
Unspecified	7,468	8,024	--	Norway 7,341; United Kingdom 664; Canada 18.
Fertilizer materials:				
Crude, n.e.s	2,819	3,573	--	All from United Kingdom.
Manufactured:				
Ammonia	8,459	265	--	United Kingdom 205; West Germany 48; Netherlands 12.
Nitrogenous	339,406	374,316	--	Netherlands 62,491; West Germany 61,824; East Germany 40,932.
Phosphatic	159,048	109,297	30,329	Sweden 35,499; Netherlands 14,224.
Potassic	328,470	239,780	13,014	West Germany 139,976; East Germany 34,601; Canada 13,883.
Unspecified and mixed	570,239	572,968	29,423	United Kingdom 252,306; Netherlands 91,304; France 45,665.
Graphite, natural	5	7	1	United Kingdom 5; West Germany 1.
Gypsum and plaster	4,647	10,956	23	United Kingdom 8,074; Spain 2,450; West Germany 300.
Iodine	42	24	--	Switzerland 22; West Germany 1; United Kingdom 1.
Kyanite and related materials	220	144	--	All from United Kingdom.
Lime	914	2,512	--	United Kingdom 2,507; West Germany 4; France 1.
Magnesium compounds:				
Magnesite, crude	110	258	--	All from United Kingdom.
Oxides and hydroxides	36,092	41,993	6	United Kingdom 15,219; China 14,719; Spain 6,858.
Other	397	243	--	West Germany 234; United Kingdom 9.
Mica:				
Crude including splittings and waste	135	222	20	United Kingdom 118; Switzerland 53; Netherlands 20.
Worked including agglomerated splittings	5	6	1	United Kingdom 4; France 1.
Nitrates, crude	90	76	--	All from United Kingdom.
Phosphates, crude	7,239	5,105	1	West Germany 2,810; Morocco 2,000; United Kingdom 293.
Phosphorus, elemental	7	1	--	Mainly from United Kingdom.
Pigments, mineral:				
Natural, crude	(2)	26	--	All from United Kingdom.
Iron oxides and hydroxides, processed	2,127	2,199	56	West Germany 1,757; United Kingdom 316.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$325	$288	--	United Kingdom $155; Switzerland $67; West Germany $25.
Synthetic do.	$58	$56	$19	Switzerland $25; West Germany $6.
Pyrite, unroasted	3	25	--	United Kingdom 21; West Germany 4.
Salt and brine	102,967	107,907	1	United Kingdom 52,514; West Germany 22,821; Spain 15,023.
Sodium compounds, n.e.s.: Carbonate, manufactured	13,970	11,726	--	United Kingdom 8,860; Netherlands 1,286; Poland 1,040.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	5,371	7,441	--	United Kingdom 3,126; Republic of South Africa 2,677; Italy 483.
Worked	6,839	5,718	18	Italy 2,339; Spain 1,544; United Kingdom 1,157.
Dolomite, chiefly refractory-grade	1,183	1,178	--	United Kingdom 794; Netherlands 310; Sweden 36.
Gravel and crushed rock	240,684	280,744	1	United Kingdom 280,008; France 540; Italy 171.
Limestone other than dimension	19,804	24,093	--	All from United Kingdom.
Quartz and quartzite	590	305	4	Portugal 160; United Kingdom 61; Belgium-Luxembourg 30.
Sand other than metal-bearing	90,725	98,045	71	United Kingdom 66,185; Norway 809; Netherlands 565.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur:				
Elemental:				
Crude including native and by-product	327	391	14	United Kingdom 239; West Germany 106; Belgium-Luxembourg 22.
Colloidal, precipitated, sublimed	45	98	--	United Kingdom 97; West Germany 1.
Dioxide	696	750	--	Sweden 621; United Kingdom 75; Netherlands 54.
Sulfuric acid	80,815	74,473	--	Norway 24,979; United Kingdom 24,913; France 15,825.
Talc, steatite, soapstone, pyrophyllite	2,143	1,643	41	United Kingdom 748; Belgium-Luxembourg 384; Netherlands 155.
Vermiculite, perlite, chlorite	3,868	2,513	--	United Kingdom 1,933; Netherlands 560; Italy 14.
Other:				
Crude	5,005	4,129	17	United Kingdom 1,929; France 1,245; Belgium-Luxembourg 444.
Slag and dross, not metal-bearing	2,614	2,454	--	Belgium-Luxembourg 1,389; Netherlands 1,001; United Kingdom 64.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2,005	2,871	--	United Kingdom 2,641; Trinidad and Tobago 206; Italy 19.
Carbon:				
Carbon black	7,382	6,109	2	United Kingdom 3,702; Sweden 1,896; Netherlands 224.
Gas carbon	340	190	--	Italy 96; West Germany 49; United Kingdom 39.
Coal:				
Anthracite thousand tons	87	60	6	Netherlands 18; United Kingdom 15; Republic of South Africa 12.
Bituminous do.	1,824	2,562	969	Poland 748; United Kingdom 501; Colombia 205.
Lignite including briquets do.	22	37	--	West Germany 31; East Germany 4; United Kingdom 2.
Coke and semicoke do.	7	5	--	Mainly from United Kingdom.
Gas, manufactured	26	123	NA	NA.
Peat including briquets and litter	947	8,106	--	Finland 6,874; United Kingdom 1,228; Denmark 2.
Petroleum:				
Crude thousand 42-gallon barrels	9,625	10,197	--	All from United Kingdom.
Refinery products:				
Liquefied petroleum gas do.	1,558	1,483	[2]	United Kingdom 1,271; Netherlands 150; Norway 29.
Gasoline do.	4,956	5,158	[2]	United Kingdom 4,599; Netherlands 346; France 211.
Mineral jelly and wax do.	34	33	2	United Kingdom 26; West Germany 2.
Kerosene and jet fuel do.	2,606	2,871	[2]	United Kingdom 2,299; U.S.S.R. 394; France 178.
Distillate fuel oil do.	6,862	8,458	[2]	United Kingdom 7,211; France 635; U.S.S.R. 610.
Lubricants do.	339	353	11	United Kingdom 300; Greece 11.
Residual fuel oil do.	7,617	12,209	653	United Kingdom 3,687; Spain 3,060; France 1,813.
Bitumen and other residues do.	517	531	--	United Kingdom 365; France 159; Belgium-Luxembourg 6.
Bituminous mixtures do.	21	27	[2]	United Kingdom 24; Canada 1; Italy 1.
Petroleum coke do.	234	350	316	Netherlands 30; West Germany 4.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.

COMMODITY REVIEW

METALS

The 800,000-ton-per-year Aughinish alumina plant reached full capacity during its fifth year of operation.

Exploration and evaluation of discovered deposits of base metals and gold continued to escalate. A few base metals as well as gold deposits appeared promising for mine development but required further evaluation.

INDUSTRIAL MINERALS

Barite mining decreased nearly one-half because of decreasing oil-well-drilling activity in the North Sea and limited reserves in the surface mines. Decreased output of sand and gravel and crushed stone reflected lowered activity in the contruction industry.

New gypsum deposits were being evaluated by North West Exploration Ltd. near Glangevlin, County Cavan. A talc-magnesite deposit at Westport, County Mayo, was being investigated by Tara Prospecting Ltd.

MINERAL FUELS

Total energy requirements, about 10 million tons of oil equivalent, were supplied by imported oil, 48%; imported coal, 22%; indigenous natural gas, 14%; indigenous peat, 13%; and hydropower, 3%. Approximately 30% of total fuel consumption was for electrical power for which the energy sources were coal, 32%; oil, 26%; gas, 20%; peat, 18%; and hydro, 4%. Coal continued to replace oil in power generation. The 900-megawatt coal-burning power station at Moneypoint reached full operation during 1987. Gas supply was expected to remain constant over the next 20 years barring discovery of new offshore resources. The Irish Supreme Court ruled early in the year that Marathon Petroleum Ireland Ltd., the sole producer, was not required to increase gas output. Approximately 3 million tons of peat was burned for electric power during 1987 and this rate was expected to continue for about 20 years. Peat costs more per unit of power generated than other fuels, but peat production was continued in order to provide employment. A large coalfield had been discovered during petroleum exploration in the Celtic Sea. The deposit was determined to be beneath Dublin and to extend into the sea. It was estimated to contain about 1 billion tons of recoverable coal, sufficient for several centuries at the current usage rate, and might one day replace coal imports. The United States continued to supply nearly 50% of Ireland's coal, based on long-term contracts signed in 1982 when this source was the least expensive and the most secure. However, the Irish power industry indicated that Australian coal could be delivered to Irish ports in 1987 at a lower cost than U.S. coal. Irish coal production was very minor.

BP Petroleum Development Ltd. produced oil during a test evaluation at a maximum daily flow rate of 1,930 barrels from wildcat well drilled in block 49/9-4 in the North Celtic Sea Basin. This well was only 2 miles from Gulf Oil (Ireland) Ltd.'s 49/9-4 well, which had flowed 9,901 barrels per day in 1983. BP had taken over Gulf's Celtic Sea interests in a 60-40 partnership with Atlantic Resources PLC, an Irish firm. Two other wells drilled in the North Celtic Sea Basin, BP's 50/6-2 well and Total Oil Marine Ltd.'s 57/2-2 well, were plugged and abandoned as dry holes.

The Irish Government modified its oil and gas production licensing and taxation policies in October to further encourage private industry to search for and develop offshore petroleum fields. These changes were the elimination of all royalty payments, an allowed deductibility of 100% of capital exploration and development costs against corporate taxes, and the complete elimination of the Government's right to venture participation. On the other hand, the Government allowed itself tax revenues from large fields of 60% instead of the usual 50%. These large fields were defined as those that had produced 100 million barrels of oil or 600 billion cubic feet of gas.

Many firms had abandoned the Irish offshore areas over the previous few years, partly because of the tax regime and the fact that no new discoveries had been made after exploration and appraisal expenditures totaling $1.5 billion.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Irish pounds (If) to U.S. dollars at the rate of If1 = US$1.49, the average for 1987.

The Mineral Industry of Israel

By T. John Rowland[1]

The mineral industry of Israel remained primarily based on industrial minerals obtained from brine deposits of the Dead Sea and from phosphate rock mines. In 1987, mineral production was similar to that of 1986, with the exception of increases in the production of natural gas, petroleum, and phosphate rock.

Negev Phosphates Ltd. (NPL) invested $4.2 million[2] to develop a flotation plant at Nahal Zin. This new 1-million-ton-per-year-capacity unit was designed to enable up to 80% recovery of the phosphate rock treated.

Commercial quantities of oil were discovered in the Helez Field southeast of Ashkelon. The discovery, when developed, was expected to produce about 100 barrels per day.

The Israeli Energy and Infrastructure Ministry selected a field test site at Sde Boker for the production of electricity from solar energy.

PRODUCTION AND TRADE

The Israeli economy continued to operate under the Government's economic stabilization program of July 1985. The principal objectives of the program were to arrest inflation and to reduce the Israeli balance of payments. In 1987, the Israeli gross national product (GNP) rose by 6.2% compared with a 4% rise in 1986. Productivity in the private sector increased by 3%; however, overall consumption continued to increase as well. The rate of inflation decreased for the second consecutive year, from a 1986 rate of 19.7% to 16.3%, the lowest rate in 15 years. Building industry activity rose by 8% after a prolonged slump. The cutting and polishing of imported rough diamonds increased. Consumption increases continued, including a consumption rise of 6% in durable goods. Public consumption increased by 18% as a result of defense-related import purchases.

The Israeli trade deficit increased by 37.4% to $3.23 billion compared with $2.35 billion in 1986 and was the highest since the 1983 deficit of $3.49 billion. Total exports amounted to $8.22 billion, up 11% from that of 1986, of which about $2.75 billion was destined for the European Economic Community (EEC), $2.75 billion to the United States, and $1.04 billion to Asia (specifically Hong Kong and Japan). Exports to the EEC, the European Free Trade Association (EFTA), and Japan constituted about 43% of Israeli exports, although Israeli exports to the United States amounted to about 33% of the total. Israeli imports reached $11.45 billion, with 53% from the EEC, 16% United States, and 10% from the EFTA. The principal countries that exported products and materials to Israel were, in descending order of importance, the United States, Belgium-Luxembourg, the Federal Republic of Germany, and the United Kingdom. The principal countries of destination for Israeli exports in 1987 were, in descending order of importance, the United States, the United Kingdom, Japan, and the Federal Republic of Germany.

Although U.S. dollar revenues increased by 10%, the volume of trade declined as the dollar value declined. However, revenues from trade with European countries rose 40% and raised that share of the market to 25% in 1987. The depreciation of the dollar relative to European and Japanese currencies assisted in an appreciable rise in the

nominal dollar value of Israeli sales.

Preparatory activities were under way to remove the duties on imports from the EEC that are scheduled to be imposed in January 1989. Nearly 90% of goods are expected to be exempt from import duties. The reduction in tariffs implemented on January 1, 1987, on imports from the EEC and the United States, was estimated to have reduced Israeli revenues by $200 million for 1987.

Israel, a major diamond-cutting and polishing center, increased diamond activities over the last 3 years. Imports of rough diamonds were 7.9 million carats in 1987, an increase of 0.7 million carats more than that of 1986. Nearly 30% of the imported rough diamonds was purchased from De Beers Diamond Trading Co. Net sales of polished diamonds totaled $2.1 billion in 1987 compared with $1.7 billion in 1986. Net sales by weight amounted to 3.9 million carats in 1987, an increase from 3.4 million carats in 1986. The United States received nearly 50% of the sales with, other significant amounts exported to Japan and Hong Kong.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Copper, oxide (80%-90% Cu):[e]					
Gross weight	4,200	3,500	--	--	--
Cu content	3,500	2,900	--	--	--
Iron and steel: Steel, crude[e]	150,000	200,000	150,000	130,000	150,000
INDUSTRIAL MINERALS					
Bromine:[e]					
Elemental	70,000	90,700	100,000	105,000	110,000
Compounds	50,500	65,300	70,000	73,000	78,000
Cement, hydraulic (from domestic clinker) thousand tons	2,058	2,064	2,020	[3]2,059	2,060
Clays:					
Bentonite	6,838	5,898	[r e]6,000	6,000	6,000
Flint clay[e]	[3]9,108	9,000	9,000	9,000	9,000
Kaolin[e]	[3]26,844	27,000	27,000	27,000	27,000
Other[e]	[3]18,274	19,000	19,000	19,000	19,000
Gypsum	42,000	46,000	[e]45,000	45,000	45,000
Lime[e]	[3]41,000	50,000	50,000	50,000	50,000
Nitrogen: N content of ammonia	53,400	57,500	57,500	57,000	57,000
Phosphate rock, beneficiated thousand tons	2,969	3,312	4,076	[3]3,673	3,798
Potash, K_2O equivalent do.	1,000	1,100	1,200	[3]1,255	1,300
Salt, marketed (mainly marine)[e]	145,000	145,000	150,000	150,000	150,000
Sand:					
Glass sand	61,000	61,000	[e]61,000	61,000	61,000
Other (for building industry) thousand tons	4,300	4,300	[e]4,300	4,300	4,500
Sodium and potassium compounds: Caustic soda	30,974	28,501	31,248	27,000	27,000
Stone:					
Crushed thousand cubic meters	4,500	6,000	[e]6,000	6,000	6,000
Dimension, marble	12,000	13,000	[e]13,000	13,000	13,000
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural, marketed million cubic feet	6,300	2,400	2,125	1,400	1,585
Peat[e] thousand tons	20	20	20	20	20
Petroleum:					
Crude thousand 42-gallon barrels	92	365	365	365	420
Refinery products:					
Gasoline do.	9,410	8,830	9,855	10,950	11,000
Kerosene and jet fuel do.	5,560	5,256	5,475	5,110	5,000
Distillate fuel oil do.	11,600	9,640	[e]9,600	10,000	10,000
Residual fuel oil do.	22,500	19,300	[e]19,000	19,000	19,000
Other do.	2,580	2,250	[e]2,200	2,000	2,000
Refinery fuel and losses do.	2,580	2,260	[e]2,300	2,000	2,000
Total do.	54,230	47,536	[e]47,200	47,000	49,000

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

[1]Table includes data available from the Apr. 1987 monthly Bulletin of Statistics, Israel Central Bureau of Statistics, v. 38, No. 4, Jerusalem; and the Israel Geological Survey.

[2]In addition to the commodities listed, Israel reportedly had the capacity to produce 71 tons of U_3O_8 per year; however, output is not reported, and available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

COMMODITY REVIEW

INDUSTRIAL MINERALS

The Government-owned holding company, Israel Chemicals Ltd. (ICL), conducted Israeli mineral extraction operations. Production from operations included various chemicals from the Dead Sea brines, and phosphates from phosphate rock in the Negev Desert. ICL subsidiaries administered downstream production operations, transportation, and the bulk of the ICL product-marketing activities.

Bromine.—The Dead Sea Bromine Group (DSB) comprises Dead Sea Bromine Ltd., Bromine Compounds Ltd., and Broomchemie BV in the Netherlands. DSB continued as a leading bromine producer responsible for about 50% of the international trade in bromine. Elemental bromine was produced from concentrated brines and upgraded into a range of bromine compounds. These compounds were divided into four categories: inorganic, organic, agricultural, and flame retardants. A $70 million investment program was under way and was aimed principally at increasing production capacity from the current 175,000 tons per year to 220,000 tons per year by 1989.

Clays.—Negev Ceramic Materials Ltd., a subsidiary of ICL, produced mainly flint clay at its plant in its Ramon Valley in the Negev Desert. Operations included open pit mining, size reduction, fines removal, magnetic separation, compaction, and calcination. Raw material from the sedimentary deposits consisted of anatase, boehmite, diaspore, hematite, and kaolinite. A variety of industrial mineral products was produced: flint clay, glass sand, kaolinite, metabentonite, and sodium feldspar.

Fertilizer Materials.—Production of phosphate rock increased to 3.79 million tons in 1987 compared with 3.67 million tons in 1986. Higher local production costs resulting from the relatively low shekel-U.S. dollar exchange rate contributed to a lower monetary return. However, the 5-year phosphate downturn was believed to be reversing as a result of increased demand in Latin America and the Far East. U.S. levies on Canadian phosphate were expected to indirectly assist the volume of sales of Israeli phosphate to the United States. Levies on Canadian phosphate exports by the United States could make Israeli phosphates more attractive to U.S. markets.

NPL operated three phosphate mines: Zin, the main plant with a capacity of 2.5 million tons per year, Arad, and Oron. Overall capacity of the three mines was 3.5 million tons per year. NPL also produced technical-grade phosphoric acid with a company capacity of 25,000 tons per year.

NPL invested $4.2 million to develop a new flotation plant at its Nahal Zin phosphate mine. When completed, the 1-million-ton-per-year unit will utilize a new technology process that will enable up to 80% of the phosphate located to be recovered at commercial grade. At the Oron Mine, a flash calciner installed in 1986 operated at a capacity of 500,000 tons per year. Excavation equipment was also upgraded by NPL at Oron as electrical excavators and loaders replaced the mechanical types.

Rotem Fertilizers Ltd., a subsidiary of ICL, produced phosphoric acid near Arad from low-grade, unexportable phosphate rock. Phosphoric acid and phosphate rock were utilized to produce granulated superphosphate rock, and potash was used to produce granulated superphosphates and PK fertilizers. Production capacities for the Rotem Fertilizers operations were rated at 180,000 tons per year of phosphoric acid and 300,000 tons per year of fertilizers.

Fertilizers and Chemicals Ltd. installed a new plant to produce nitric acid for the manufacture of agricultural nitrate fertilizers. The $9 million plant, using technology developed in the United States, was anticipated to be capable of producing 100,000 tons per year of 60% nitric acid, reported as sufficient to continue to meet the Israeli needs for 10 years.

Magnesium Compounds.—The Dead Sea Periclase Ltd. manufactured high-purity magnesium oxide, periclase, and calcined magnesia specialty products. Dead Sea Periclase was established in 1971 to meet the demand for high-purity sintered magnesia for the refractories industry. The company applies the Aman process for the decomposition of magnesium chloride brines to produce the periclase. Periclase was used to manufacture refractory bricks principally for lining steel industry furnaces. Specialty magnesia products categorized by manufactured application included transformer steel, rubber, adhesives, plastics, pharmaceuticals, high-purity chemical feedstocks, and nuclear-grade fused magnesia. A $10 million expansion program, scheduled for

completion in early 1988, was expected to increase annual production capacity by 20,000 tons to 70,000 tons per year. The new plant is planned to incorporate unit operations for washing, milling, drying, and calcination. Individual processing units were designed to accommodate operations for a variety of product configurations. Finished products are expected to be handled by separate packing lines, thereby eliminating product contamination.

MINERAL FUELS

Coal.—In 1987, the principal suppliers of coal for Israel continued to be, in descending order of tonnage, the Republic of South Africa, Australia, the United States, and Colombia. The estimated total tonnage of imported coal was 3.3 million tons during 1987. In early 1987, Israel contracted to purchase 2.1 million tons of coal from Colombia to be delivered incrementally through the end of the decade. Coal satisfied 47% of Israeli energy consumption, while liquid fuels supplied 51% of energy demand.

Petroleum.—The Israel National Oil Co. discontinued exploration ventures after investing $250 million over 9 years. Israel imports 50 million barrels of crude oil per year under long-term contracts with Egypt, Mexico, and Norway, and through the spot market. In 1987, Israel operated two refineries: Haifa with a 110,000-barrel-per-day capacity and Ashdod, with a 70,000-barrel-per-day capacity. Refinery production by Israel during 1987 included kerosene, gasoline, liquefied petroleum gas, and naphtha, and was sufficient for Israeli demand.

In March, a commercial quantity of oil was discovered at a depth of 4,800 feet in the Helez Field southeast of Ashkelon near Qiryat Gat. This discovery was expected to produce at a rate of about 100 barrels per day. The current oil production rate from all other Israeli sites totaled about 150 barrels per day. Approximately 97% of the Israeli energy requirements was imported in 1987.

Solar and alternative energy sources supplied the remaining 3% of demand. Israel was one of the world leaders in the use of solar energy for heating water. The Energy and Infrastructure Ministry continued support of studies in the production of steam and in the direct and indirect conversion of solar energy to electrical energy during 1987. A site was selected at Sde Boker to field test technologies for producing electricity from solar energy. This central experimental site, the Ben-Gurion Center, is expected to expand Israeli experience and capabilities in solar energy utilization and to assist in reaching the goal of satisfying 4% of Israeli energy needs by the year 2000.

Israel has an estimated 10 billion tons of oil shale reserves. Research continued on oil shale, primarily through universities and the Government corporation Energy Resources Development Ltd. A 4.5-megawatt cogeneration powerplant fueled by oil shale was planned to be built at Mishor Rotem at a construction cost of $21 million. Completion was scheduled for 1989.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from New Israeli shekels (I) to U.S. dollars at the average rate of I1.60=US$1.00 for 1987.

The Mineral Industry of Italy

By John G. Panulas[1]

Italy's mining activities accounted for an estimated 5% of the country's 1987 gross national product of about $670 billion.[2] Italy continued to be a major producer of pumice and feldspar. Output of asbestos, barite, bentonite, cement, fluorspar, magnesite, potash, and talc were also of world importance.

Ente Nazionale Idrocarburi (ENI), Italy's state mining organization, continued reorganization of its subsidiary Società per Azioni Minero-Metallurgiche (SAMIM). The mining operations of SAMIM were moved to Società Italiana Minière, a subsidiary of Azienda Generali Italiana Petroli-Minière S.p.A. (AGIP Minière). Smelting and metallurgical activities were transferred to SAMIM's successor company, Nuova Società per Azioni Minero-Metallurgiche.

PRODUCTION

The Italian mining industry posted negligible growth in 1987. Production of metallic minerals grew very slightly. Smelter and refinery production of most metals either remained constant or fell somewhat. Output of industrial minerals, although significant to the extractive sector, showed little growth. Likewise, industrial mineral products posted only slight gains. In general, petroleum and natural gas sustained their previous output levels.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Bauxite	13,100	--	--	--	--
Alumina	465,671	607,274	555,319	618,374	[2]699,635
Metal:					
Primary	195,694	230,207	221,055	242,632	[2]228,230
Secondary	278,000	283,000	282,000	[e]280,000	280,000
Antimony:					
Mine output, Sb content	--	244	495	305	300
Metal, total	720	1,121	1,039	715	700
Bismuth metal	23	26	54	66	70
Cadmium metal, smelter	385	452	526	411	[2]325
Copper:					
Mine output, Cu content	1,538	875	130	--	--
Metal, refined, all kinds	31,200	50,300	64,300	64,800	65,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS —Continued					
Iron and steel: Metal:					
Pig iron ---- thousand tons	10,341	11,628	11,658	11,898	[2]10,400
Ferroalloys:					
Blast furnace:					
Ferromanganese	50,274	36,092	50,111	48,002	50,000
Spiegeleisen	494	935	1,001	1,151	1,200
Silicon pig iron (10%-12% Si)	580	342	686	968	1,000
Electric furnace:					
Ferrochromium	45,414	49,942	57,654	55,939	56,000
Ferromanganese	12,647	15,651	17,166	11,653	12,000
Ferrosilicon	51,913	71,157	75,302	62,799	63,000
Silicomanganese	37,244	72,779	64,858	66,083	67,000
Silicon metal	11,737	22,812	17,812	968	1,000
Other	42,219	50,755	15,862	14,022	14,000
Total	252,522	320,465	300,452	261,585	265,200
Steel, crude ---- thousand tons	21,674	24,061	23,744	22,869	22,900
Semimanufactures:					
Wire rod ---- do	2,027	2,027	2,256	[e]2,000	2,000
Sections ---- do	6,874	6,874	7,135	[e]7,000	7,000
Plates and sheets ---- do	8,409	5,836	5,062	[e]5,000	5,000
Hoop and strip ---- do	461	461	526	[e]500	500
Railway track material ---- do	234	234	280	[e]200	200
Ingots, semimanufactures, solids for tubes ---- do	957	948	1,198	[e]1,100	1,100
Castings and forgings ---- do	453	435	326	[e]300	300
Other ---- do	1,515	1,524	1,383	[e]1,500	1,500
Total ---- do	20,930	18,339	18,166	[e]17,600	17,600
Lead:					
Mine output, Pb content	23,561	20,883	15,622	11,119	[2]19,284
Metal, refined:					
Primary	36,955	37,558	29,538	29,333	66,000
Secondary	89,400	102,900	96,700	101,700	94,000
Magnesium:					
Mine output, Mg content	9,781	9,300	9,831	9,046	9,500
Metal, primary	7,687	7,491	7,863	12,417	[2]7,173
Manganese, mine output:					
Gross weight	7,205	9,582	8,621	6,396	3,400
Mn content	2,215	2,858	2,586	1,689	1,000
Silver metal ---- thousand troy ounces	2,361	1,554	2,301	1,813	[2]2,668
Zinc:					
Mine output, Zn content	42,944	42,288	45,438	26,303	26,000
Metal, primary	155,893	169,672	215,644	229,397	230,000
INDUSTRIAL MINERALS					
Asbestos	139,054	147,272	136,006	115,208	115,000
Barite	139,090	107,128	128,356	114,132	115,000
Bromine[e]	500	500	600	450	520
Cement, hydraulic ---- thousand tons	39,216	37,782	36,677	35,340	[2]36,200
Clays, crude:					
Bentonite ---- do	297	309	304	300	[2]313
Refractory excluding kaolinitic earth ---- do	284	332	400	381	[2]375
Fuller's earth ---- do	20	30	30	31	30
Kaolin ---- do	53	53	60	35	[2]125
Kaolinitic earth ---- do	25	25	26	21	22
Diatomite[e]	25,000	28,000	30,000	27,000	27,000
Feldspar	826,856	985,573	1,115,575	1,237,058	[2]1,173,663
Fluorspar:					
Acid-grade	102,910	110,330	95,450	90,900	[2]80,300
Metallurgical-grade	74,760	77,931	56,762	54,536	[2]56,600
Total	177,670	188,261	152,212	145,436	[2]136,900
Graphite, all grades	2,299	--	--	--	--
Gypsum ---- thousand tons	1,388	1,264	1,261	[e]1,300	[2]1,233
Lime, hydrated and quicklime ---- do	2,021	2,402	2,276	[e]2,100	2,300
Nitrogen: N content of ammonia ---- do	1,060	1,210	1,217	[e]1,200	1,200
Perlite[e]	75,000	80,000	80,000	70,000	70,000
Pigments, mineral: Iron oxides, natural[e]	900	800	850	875	900
Potash, crude salts:					
Gross weight ---- thousand tons	1,674	1,481	1,701	1,261	[2]1,401
K_2O equivalent ---- do	184	162	205	158	[2]168

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Pumice and related materials:					
Pumice and pumiceous lapilli thousand tons	931	903	[e]750	[e]700	[2]725
Pozzolan do	5,590	5,712	[e]5,000	[e]4,500	5,000
Pyrites, all types, gross weight do	646	443	690	761	770
Salt:					
Marine, crude[3] do	736	723	570	574	[2]571
Rock and brine do	3,454	3,255	3,176	3,433	3,500
Sand and gravel:					
Volcanic sand do	110	115	[e]110	[e]100	100
Silica sand do	4,085	4,415	[e]4,400	[e]4,200	4,300
Other sand and gravel do	124,000	120,694	[e]122,000	[e]123,000	122,000
Sodium and potassium compounds:[e]					
Caustic soda	9,000	8,000	8,500	8,700	8,700
Sodium carbonate thousand tons	855	90	90	80	[2]85
Sodium sulfate do	90	80	80	75	80
Stone:					
Dimension:[4]					
Calcareous:					
Alabaster and onyx do	20	17	[e]20	[e]20	20
Marble in blocks:					
White do	2,256	1,777	[e]1,500	[e]1,600	1,600
Colored do	1,785	1,756	[e]1,800	[e]1,800	1,800
Schist (calcareous) do	496	510	[e]500	[e]500	500
Travertine do	1,075	1,066	[e]1,100	[e]1,100	1,100
Tufa do	4,521	5,207	[e]5,000	[e]4,500	4,500
Other:					
Gneiss do	259	319	[e]300	[e]300	300
Granite do	2,556	2,385	[e]2,500	[e]2,500	2,500
Lava, basalt, trachyte do	6,879	8,799	[e]7,000	[e]8,000	8,000
Porphyry do	1,226	1,205	[e]1,200	[e]1,200	1,200
Sandstone do	1,781	1,855	[e]1,800	[e]1,800	1,800
Slate do	119	124	[e]120	[e]120	120
Tuff, volcanic do	5,826	5,930	[e]5,900	[e]5,800	5,800
Crushed and broken:					
Dolomite do	849	887	[e]900	[e]850	850
Limestone do	120,000	117,025	[e]120,000	[e]110,000	110,000
Marl for cement do	11,653	11,502	11,458	10,574	11,000
Serpentine do	2,339	1,204	[e]1,500	[e]1,500	1,500
Quartz and quartzite do	266	316	[e]300	[e]250	250
Strontium minerals: Celestite	414	--	4,611	4,667	177
Sulfur:					
Gross weight of ore thousand tons	41	20	5	--	--
Recovered as elemental and in compounds:					
Elemental from ore do	9	8	1	--	--
S content of pyrites do	271	192	280	309	300
Byproduct, oil refining[e] do	10	10	10	10	10
Byproduct, other sources[e] do	200	190	190	175	180
Total do	490	400	481	494	490
Talc and related materials	158,974	142,727	129,614	151,206	148,028
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bituminous rock, natural	93,306	91,988	88,700	65,889	66,000
Carbon black[e]	150,000	160,000	150,000	155,000	156,000
Coal:					
Lignite thousand tons	1,737	1,806	1,892	1,573	1,600
Subbituminous (Sulcis coal)	4,458	8,112	18,773	13,708	13,700
Coke, metallurgical thousand tons	6,419	6,920	7,377	[e]7,000	8,000
Gas, natural: Marketed million cubic feet	458,930	488,650	503,058	563,735	564,000
Natural gas liquids thousand 42-gallon barrels	383	383	360	[e]400	400
Petroleum:					
Crude do	14,961	15,635	16,024	17,230	17,000
Refinery products:					
Liquefied petroleum gas do	22,132	21,286	19,964	[e]20,000	20,000
Gasoline, all kinds do	125,732	123,522	124,617	[e]120,000	120,000
Naphtha do	24,269	22,876	27,175	[e]25,000	25,000
Jet fuel do	7,880	8,664	9,400	[e]9,000	9,000
Kerosene do	18,933	18,514	17,042	[e]18,000	18,000
Distillate fuel oil do	172,288	171,557	169,499	[e]170,000	170,000
Residual fuel oil do	190,322	173,466	146,087	[e]150,000	150,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Other thousand 42-gallon barrels	41,300	40,957	43,988	[e]40,000	40,000
Refinery fuel and losses do	46,167	48,631	36,735	[e]45,000	45,000
Total do	649,023	629,473	594,507	[e]597,000	597,000

[e]Estimated. [p]Preliminary.
[1]Table includes data available through Sept. 22, 1988.
[2]Reported figure.
[3]Reported production from Sardinia and Sicily estimated at 200,000 tons annually.
[4]Output of limestone and serpentine for dimension stone use is included with "Stone: Crushed and broken."

TRADE

In metalliferous ore trade with the world, Italy's losses increased from $332 million in 1985 to $388 million in 1986, while the outflow resulting from its transactions in industrial minerals decreased from $1.5 billion to $1.4 billion. Correspondingly, in trade with its partners within the European Economic Community (EEC), Italy's commerce in metalliferous ores produced a deficit of $174 million, up $63 million from that of 1985. But industrial minerals sales to the EEC resulted in a deficit reduction of $106 million, down from $693 million in 1985 to $587 million in 1986. Notably in 1986, the country enjoyed surpluses of $2.4 billion and $921 million in its trade of industrial mineral products with the world and the EEC, respectively.

Table 2.—Italy: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	495	302	--	Iraq 104; France 67; Switzerland 59.
Alkaline-earth metals	4	25	(2)	Belgium-Luxembourg 13; Switzerland 12.
Aluminum:				
Ore and concentrate	7,273	4,502	--	Turkey 3,592; Tunisia 600; Greece 150.
Oxides and hydroxides	283,421	338,359	166	Netherlands 118,700; Yugoslavia 66,451; Norway 35,932.
Ash and residue containing aluminum	7,373	6,973	--	West Germany 3,754; France 1,907; Belgium-Luxembourg 1,132.
Metal including alloys:				
Scrap	5,816	4,239	21	West Germany 2,866; France 931; Belgium-Luxembourg 166.
Unwrought	43,797	34,307	187	West Germany 11,653; France 6,561; Netherlands 4,248.
Semimanufactures	134,664	138,516	8,191	West Germany 41,582; France 24,866; United Kingdom 10,409.
Antimony:				
Ore and concentrate	582	30	--	NA.
Oxides	362	115	--	West Germany 82; United Kingdom 10; Switzerland 5.
Metal including alloys, all forms	1	24	--	Belgium-Luxembourg 19; France 2; Spain 2.
Arsenic: Oxides and acids	24	17	--	Spain 8; France 6; Morocco 2.
Beryllium:				
Oxides and hydroxides	38	24	1	France 23.
Metal including alloys, all forms	20	(2)	--	All to United Kingdom.
Bismuth: Metal including alloys, all forms	40	25	--	United Kingdom 23; West Germany 1.
Cadmium: Metal including alloys, all forms	322	224	--	Netherlands 121; Belgium-Luxembourg 62; United Kingdom 20.

See footnotes at end of table.

Table 2.—Italy: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Cesium and rubidium: Metal including alloys, all forms	5	4	--	Portugal 3; West Germany 1.
Chromium:				
Ore and concentrate	1,544	3,710	5	Austria 2,561; Yugoslavia 825; France 168.
Oxides and hydroxides	25,549	NA		
Metal including alloys, all forms	138	212	--	West Germany 137; France 45; Spain 25.
Cobalt:				
Ore and concentrate	2	--		
Oxides and hydroxides	20	43	--	Ecuador 25; West Germany 12; France 3.
Metal including alloys, all forms	55	87	--	United Kingdom 36; France 18; West Germany 11.
Columbium and tantalum: Metal including alloys, all forms:				
Columbium (niobium)	(2)	1	--	Mainly to France.
Tantalum	6	11	--	West Germany 10.
Copper:				
Ore and concentrate	1,685	25	--	Austria 23; Netherlands 2.
Matte and speiss including cement copper	1,192	556	3	Spain 552.
Oxides and hydroxides	2,042	1,722	73	West Germany 631; Netherlands 172; France 133.
Ash and residue containing copper	5,084	4,997	21	West Germany 2,732; Austria 1,181; India 369.
Metal including alloys:				
Scrap	14,814	10,897	--	West Germany 8,154; France 895; Belgium-Luxembourg 571.
Unwrought	14,112	8,805	447	Belgium-Luxembourg 2,023; France 1,948; Spain 1,060.
Semimanufactures	124,236	130,334	5,233	France 31,517; West Germany 23,002; Spain 13,285.
Germanium: Metal including alloys, all forms	1	4	--	Belgium-Luxembourg 2; Sweden 2.
Gold:				
Waste and sweepings value, thousands	$13	$102	$3	Republic of South Africa $33; West Germany $17; Japan $13.
Metal including alloys, unwrought and partly wrought troy ounces	166,189	94,267	25,046	Switzerland 29,161; United Kingdom 9,870.
Hafnium: Metal including alloys, all forms	(2)	(2)	--	All to Tunisia.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	35	2,520	--	Brazil 2,500; China 12; Austria 8.
Pyrite, roasted	22,873	43,235	--	France 17,883; Greece 15,719; Lebanon 8,101.
Metal:				
Scrap	9,861	7,261	58	West Germany 3,371; France 2,617; Morocco 474.
Pig iron, cast iron, related materials	33,234	74,406	137	East Germany 30,446; West Germany 16,287; Spain 8,600.
Ferroalloys:				
Ferrochromium	24,401	24,396	301	West Germany 14,402; France 4,059; United Kingdom 3,105.
Ferromanganese	301	383	--	West Germany 131; France 129; Austria 26.
Ferromolybdenum	175	38	--	Yugoslavia 29; United Kingdom 7; Greece 2.
Ferronickel	(2)	239	--	France 166; Austria 71; Israel 1.
Ferrosilicochromium	191	46	--	West Germany 24; France 22.
Ferrosilicomanganese	2,677	5,197	454	France 3,087; West Germany 1,303.
Ferrosilicon	16,782	12,306	830	France 4,753; West Germany 4,475.
Silicon metal	9,973	8,810	--	West Germany 3,648; Japan 3,137; United Kingdom 526.
Unspecified	7,648	8,652	17	United Kingdom 1,155; West Germany 1,153; Romania 1,018.
Steel, primary forms thousand tons	1,138	1,194	79	France 170; Argentina 122; China 114.

See footnotes at end of table.

Table 2.—Italy: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections do	2,569	2,280	13	West Germany 830; France 619; Switzerland 166.
Universals, plates, sheets do	1,805	1,350	155	France 214; U.S.S.R. 165; West Germany 161.
Hoop and strip do	185	187	3	France 51; West Germany 41; Austria 14.
Rails and accessories do	16	18	(2)	Bangladesh 6; Switzerland 5; Senegal 3.
Wire do	173	198	7	France 52; West Germany 32; Switzerland 23.
Tubes, pipes, fittings do	2,092	2,001	114	U.S.S.R. 667; West Germany 280; France 182.
Castings and forgings rough do	59	51	2	Yugoslavia 12; France 5; U.S.S.R. 5.
Lead:				
Ore and concentrate	24,907	14,498	--	Spain 4,200; Bulgaria 4,000; Yugoslavia 3,800.
Oxides	2,502	851	--	Romania 471; Egypt 109; Poland 65.
Ash and residue containing lead	4,425	7,159	--	France 5,250; Belgium-Luxembourg 1,693; United Kingdom 207.
Metal including alloys:				
Scrap	1,255	96	--	West Germany 71; Switzerland 24; France 1.
Unwrought	11,786	10,448	34	Iran 5,703; Turkey 1,047; East Germany 852.
Semimanufactures	179	276	5	Libya 81; Greece 42; Ethiopia 28.
Lithium:				
Oxides and hydroxides	18	3	--	Yugoslavia 2; Venezuela 1.
Metal including alloys, all forms	(2)	--		
Magnesium: Metal including alloys:				
Scrap	858	566	40	West Germany 392; Austria 68.
Unwrought	5,216	5,262	25	West Germany 2,303; Switzerland 862; Austria 726.
Semimanufactures	640	1,226	(2)	Belgium-Luxembourg 803; France 167; United Kingdom 98.
Manganese:				
Ore and concentrate, metallurgical-grade	1,272	1,745	--	France 948; Netherlands 758; West Germany 48.
Oxides	260	194	--	Belgium-Luxembourg 85; Netherlands 24; West Germany 21.
Metal including alloys, all forms	70	34	--	West Germany 33; France 1.
Mercury 76-pound flasks	563	45,008	--	Austria 43,616; France 870; Republic of South Africa 522.
Molybdenum:				
Ore and concentrate	43	22	--	All to Netherlands.
Oxides and hydroxides	10	(2)	--	All to Switzerland.
Metal including alloys:				
Scrap	1	35	--	West Germany 34; France 1.
Unwrought	(2)	(2)	--	Mainly to United Kingdom.
Semimanufactures	3	30	2	France 15; Yugoslavia 10.
Nickel:				
Matte and speiss	18	(2)	--	All to Canada.
Oxides and hydroxides	1	33	--	All to Cuba.
Ash and residue containing nickel	358	87	--	Austria 60; Netherlands 27.
Metal including alloys:				
Scrap	118	162	52	West Germany 91; Switzerland 9.
Unwrought	125	88	24	United Kingdom 42; Yugoslavia 8.
Semimanufactures	1,168	845	12	United Kingdom 127; France 115; West Germany 111.
Platinum-group metals:				
Waste and sweepings value, thousands	$53	$1	--	All to West Germany.
Metals including alloys, unwrought and partly wrought troy ounces	77,861	142,911	37,231	United Kingdom 33,523; West Germany 19,548.
Rare-earth metals including alloys, all forms	38	14	--	Switzerland 7; Greece 4; United Kingdom 2.
Rhenium: Metal including alloys, all forms	1	(2)	--	Mainly to United Kingdom.

See footnotes at end of table.

Table 2.—Italy: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Selenium, elemental	1	1	--	All to Venezuela.
Silicon, high-purity	214	129	42	Japan 78; West Germany 5.
Silver:				
Waste and sweepings value, thousands	$5	--		
Metal including alloys, unwrought and partly wrought thousand troy ounces	5,405	4,533	NA	Switzerland 3,807; France 145; United Kingdom 55.
Tellurium and arsenic, elemental	(2)	9	--	Pakistan 5; United Kingdom 4.
Tin:				
Ore and concentrate	--	18	--	All to Switzerland.
Oxides	238	124	--	France 40; Spain 40; West Germany 14.
Ash and residue containing tin	160	88	--	All to United Kingdom.
Metal including alloys:				
Scrap	60	200	--	West Germany 105; Netherlands 50; Belgium-Luxembourg 24.
Unwrought	197	163	--	United Kingdom 53; Netherlands 52; Yugoslavia 45.
Semimanufactures	136	110	31	West Germany 25; Switzerland 20.
Titanium:				
Ore and concentrate	1,906	1,335	--	Yugoslavia 500; France 387; Turkey 200.
Oxides	874	438	20	France 107; Yugoslavia 87; Austria 62.
Metal including alloys:				
Scrap	35	124	(2)	United Kingdom 70; West Germany 44; France 9.
Unwrought	4	(2)	--	Mainly to Yugoslavia.
Semimanufactures	90	88	5	Switzerland 37; Morocco 8; India 6.
Tungsten:				
Ore and concentrate	5	5	--	All to Austria.
Oxides and hydroxides	1	8	--	France 7; Netherlands 1.
Ashes and residues containing tungsten	4	--		
Metal including alloys:				
Scrap	46	33	--	West Germany 21; Belgium-Luxembourg 6; Austria 5.
Unwrought	125	86	61	West Germany 19; Belgium-Luxembourg 4.
Semimanufactures	15	67	15	Egypt 34; United Kingdom 6.
Uranium and thorium:				
Ore and concentrate	21	331	--	Netherlands 187; Albania 79; Argentina 60.
Metal including alloys, all forms:				
Uranium	1	--		
Thorium	--	(2)	--	All to Netherlands.
Vanadium:				
Oxides and hydroxides	1	2	--	All to Turkey.
Ash and residue containing vanadium	1,901	1,238	654	West Germany 494; Paraguay 54.
Metal including alloys:				
Scrap	--	1	--	Mainly to France.
Unwrought	(2)	(2)	--	All to Sweden.
Semimanufactures	--	2	--	Mainly to France.
Zinc:				
Ore and concentrate	25,283	14,908	--	Austria 9,008; Belgium-Luxembourg 5,027; Yugoslavia 793.
Oxides	5,334	5,057	3	West Germany 1,962; France 1,665; Belgium-Luxembourg 385.
Blue powder	315	254	--	West Germany 135; France 70; Belgium-Luxembourg 37.
Matte	555	506	42	West Germany 277; Spain 118; France 45.
Ash and residue containing zinc	6,233	6,768	25	West Germany 3,677; Belgium-Luxembourg 1,359; Spain 1,038.
Metal including alloys:				
Scrap	4,512	4,159	--	West Germany 3,584; France 192; Spain 151.
Unwrought	45,772	48,816	9,001	U.S.S.R. 7,944; Turkey 6,213.
Semimanufactures	1,776	4,377	1	West Germany 2,855; France 866; Portugal 310.

See footnotes at end of table.

Table 2.—Italy: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Zirconium:				
Ore and concentrate	5,073	8,137	--	Hungary 4,778; Brazil 815; Spain 729.
Metal including alloys:				
Scrap	9	4	(2)	Mainly to France.
Unwrought	2	5	(2)	Mainly to Sweden.
Semimanufactures	63	22	(2)	Turkey 20; France 2.
Other:				
Ores and concentrates	4,655	372	--	Spain 232; West Germany 82; France 21.
Oxides and hydroxides	37	426	2	Netherlands 75; Venezuela 65; West Germany 56.
Ashes and residues	16,789	13,203	91	Canada 3,008; Belgium-Luxembourg 2,764; West Germany 1,722.
Base metals including alloys, all forms	154	12	10	West Germany 1; Italy 1.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	109,356	93,473	22,636	United Kingdom 41,062; Algeria 12,737.
Artificial:				
Corundum	6,386	5,730	455	Bulgaria 1,167; France 757; Austria 679.
Silicon carbide	11,711	11,962	294	France 2,788; West Germany 2,755; Belgium-Luxembourg 1,117.
Dust and powder of precious and semi-precious stones including diamond kilograms	330	182	103	United Kingdom 19; France 17.
Grinding and polishing wheels and stones	27,997	22,371	1,144	France 3,270; West Germany 1,838; Saudi Arabia 1,583.
Asbestos, crude	66,244	45,187	--	West Germany 13,034; France 10,573; Spain 3,885.
Barite and witherite	27,136	3,992	--	Yugoslavia 1,805; Nigeria 1,000; Congo 680.
Boron materials:				
Crude natural borates	2,461	1,176	--	Austria 287; Yugoslavia 238; Belgium-Luxembourg 98.
Elemental	44	242	--	Libya 99; Greece 75; Yugoslavia 26.
Oxides and acids	17,307	17,903	--	Austria 12,365; Pakistan 3,318; Finland 1,783.
Bromine	73	86	--	West Germany 50; France 29; Switzerland 7.
Cement	383,633	275,133	52	Switzerland 121,730; Algeria 31,549; France 20,951.
Chalk	5,931	3,268	--	West Germany 2,782; Switzerland 330; Togo 63.
Clays, crude:				
Bentonite	28,063	20,779	36	France 10,477; Netherlands 4,309; Tunisia 2,070.
Chamotte earth	3,199	3,462	--	Tunisia 2,350; Switzerland 397; East Germany 224.
Fuller's earth	--	33	--	United Kingdom 21; France 12.
Kaolin	50,305	23,117	1	France 17,967; Tunisia 1,620; Israel 1,350.
Unspecified	14,346	16,292	20	Turkey 12,450; Switzerland 857; Tunisia 691.
Cryolite and chiolite	43	25	--	West Germany 10; Turkey 10; Greece 2.
Diamond:				
Gem, not set or strung carats	3,454	14,292	991	Belgium-Luxembourg 159; Switzerland 102; undetermined 13,040.
Industrial stones do	49,029	1,108	--	France 882.
Diatomite and other infusorial earth	4,114	3,037	--	Austria 1,282; Switzerland 567; West Germany 375.
Feldspar, fluorspar, related materials:				
Feldspar	39,139	29,413	--	West Germany 15,588; Switzerland 5,293; Algeria 1,000.
Fluorspar	44,786	11,744	--	United Kingdom 3,500; West Germany 3,250; Austria 2,327.
Unspecified	564	263	20	Austria 148; Switzerland 52; West Germany 24.

See footnotes at end of table.

Table 2.—Italy: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Fertilizer materials:				
Crude, n.e.s	24,891	24,320	302	France 9,944; Switzerland 3,202; Malta 3,000.
Manufactured:				
Ammonia	129,076	185,996	--	Greece 67,334; Spain 39,101; Turkey 35,288.
Nitrogenous	1,106,832	1,037,855	73,819	Greece 174,533; Turkey 141,221; Spain 109,406.
Phosphatic	5,477	4,007	--	Austria 1,574; Saudi Arabia 724; West Germany 348.
Potassic	111,417	66,575	104	Greece 14,500; Turkey 12,300; Algeria 10,201.
Unspecified and mixed	481,486	480,170	24	West Germany 61,189; China 55,349; France 55,237.
Graphite, natural	444	243	17	Switzerland 73; West Germany 52; France 19.
Gypsum and plaster	16,773	13,803	--	Switzerland 10,848; Greece 855; United Kingdom 431.
Iodine	2	50	--	Yugoslavia 40; West Germany 7; United Kingdom 1.
Kyanite and related materials	--	1,021	--	West Germany 766; Netherlands 104; United Kingdom 88.
Lime	39,872	34,518	270	Switzerland 33,411; Austria 302.
Magnesium compounds:				
Magnesite	2,373	719	--	Netherlands 267; Saudi Arabia 207; Switzerland 90.
Oxides and hydroxides	116,014	175,753	--	West Germany 32,133; Austria 24,631; Republic of South Africa 16,359.
Other	68	48	--	Belgium-Luxembourg 24; France 24.
Mica:				
Crude including splittings and waste	229	123	--	Belgium-Luxembourg 64; West Germany 31; Republic of Korea 18.
Worked including agglomerated splittings	34	57	--	France 27; Saudi Arabia 15; West Germany 5.
Nitrates, crude	42	128	--	United Kingdom 104; West Germany 24.
Phosphates, crude	366	224	--	Switzerland 64; Netherlands 35; France 27.
Pigments, mineral:				
Natural, crude	602	285	20	Netherlands 54; Portugal 48; Somalia 39.
Iron oxides and hydroxides, processed	9,452	7,839	1	France 1,906; West Germany 1,131; United Kingdom 856.
Potassium salts, crude	(2)	48	--	West Germany 25; Israel 10; United Kingdom 10.
Precious and semiprecious stones other than diamond:				
Natural kilograms	2,530	181	NA	Hong Kong 60.
Synthetic do	1,076	462	NA	West Germany 256; Brazil 34.
Pyrite, unroasted	4,778	4,676	445	West Germany 2,504; France 838; Austria 476.
Quartz crystal, piezoelectric kilograms	NA	1	NA	NA.
Salt and brine	428,589	619,179	219,138	Netherlands 119,710; United Kingdom 87,490.
Sodium compounds, n.e.s.: Carbonate, manufactured	53,037	57,932	--	Israel 23,338; Greece 14,009; Algeria 8,996.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	459,071	390,003	15,257	West Germany 64,252; Japan 52,443; France 35,293.
Worked	1,764,540	1,588,336	222,628	West Germany 445,880; Saudi Arabia 253,341.
Dolomite, chiefly refractory-grade	35,056	40,488	--	France 22,721; Switzerland 10,313; West Germany 3,246.
Gravel and crushed rock	803,524	858,491	2,110	Switzerland 256,243; Algeria 92,508; Kuwait 85,513.
Limestone other than dimension	3,064	869	--	Austria 484; Switzerland 177; France 175.
Quartz and quartzite	31,060	29,310	3	Switzerland 12,415; France 7,857; West Germany 5,463.
Sand other than metal-bearing	r112,162	152,607	38	Switzerland 146,411; France 1,616; Libya 509.

See footnotes at end of table.

Table 2.—Italy: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur:				
Elemental:				
Crude including native and by-product	14,455	3,633	--	Yugoslavia 2,994; France 402; Tanzania 50.
Colloidal, precipitated, sublimed	21	449	--	Libya 402; France 20; Israel 11.
Dioxide	82	535	--	Yugoslavia 355; Israel 59; Belgium-Luxembourg 50.
Sulfuric acid	117,500	111,174	7,000	Belgium-Luxembourg 20,951; Spain 18,643; Greece 13,500.
Talc, steatite, soapstone, pyrophyllite	41,987	43,076	2,637	West Germany 14,244; United Kingdom 7,444; France 5,202.
Vermiculite, perlite, chlorite	61,976	54,918	--	United Kingdom 41,000; France 13,025; Switzerland 636.
Other:				
Crude	13,716	8,996	3	Switzerland 3,086; Spain 938; France 838.
Slag and dross, not metal-bearing	187,438	416,034	--	Greece 334,246; Cyprus 52,500; Austria 19,157.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	717	1,363	62	Malta 341; Iraq 202; France 160.
Carbon:				
Carbon black	1,542	470	6	West Germany 88; France 64; Spain 63.
Gas carbon	71,350	59,523	20	Yugoslavia 16,849; Austria 9,937; Turkey 7,784.
Coal:				
Anthracite	7,039	1,786	--	France 1,564; Austria 155; Switzerland 25.
Bituminous	33,398	3,801	--	Switzerland 2,949; Yugoslavia 700.
Briquets of anthracite and bituminous coal	488	158	--	Kuwait 98; France 30; Israel 29.
Lignite including briquets	26	26	--	All to France.
Coke and semicoke	450,766	175,517	--	Austria 47,128; Romania 31,207; Hungary 28,582.
Gas natural: Gaseous million cubic feet	2	1	--	Mainly to France.
Peat including briquets and litter	154	202	--	West Germany 89; France 39; Austria 32.
Petroleum:				
Crude thousand 42-gallon barrels	1,900	1,279	(2)	West Germany 1,178; France 101.
Refinery products:				
Liquefied petroleum gas do	2,956	2,893	372	Greece 905; France 446.
Gasoline do	37,343	40,846	11,066	France 8,251; Netherlands 7,386.
Mineral jelly and wax do	50	833	422	Netherlands 388; West Germany 8.
Kerosene and jet fuel do	11,529	12,242	963	Netherlands 2,116; Iran 1,677.
Distillate fuel oil do	16,713	32,124	452	France 10,624; Netherlands 5,247; Switzerland 2,831.
Lubricants do	3,397	3,430	1	West Germany 377; Algeria 307; Netherlands 242.
Residual fuel oil do	19,490	28,389	7,422	Netherlands 7,489; Belgium-Luxembourg 2,849.
Bitumen and other residues do	871	654	(2)	Austria 330; Switzerland 187; Greece 53.
Bituminous mixtures do	25	46	2	Netherlands 15; Libya 9; Belgium-Luxembourg 6.
Petroleum coke do	64	93	--	Austria 91; Malta 1.

[r] Revised. NA Not available.
[1] Table prepared by Jozef Plachy.
[2] Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	6,123	4,959	--	France 2,957; West Germany 1,958; Austria 23.
Alkaline-earth metals	162	60	--	Belgium-Luxembourg 14; U.S.S.R. 10; Austria 5.
Aluminum:				
Ore and concentrate	1,277,114	1,395,994	14	Guinea 782,221; Australia 510,775; China 47,120.
Oxides and hydroxides	291,344	376,902	398	Guinea 121,593; West Germany 72,610; France 66,464.
Ash and residue containing aluminum	96,583	106,726	132	Austria 83,118; France 13,705; West Germany 2,359.
Metal including alloys:				
Scrap	148,472	182,129	8,618	West Germany 43,832; France 41,975; Austria 27,944.
Unwrought	319,876	347,690	21	Netherlands 80,398; West Germany 55,185; Yugoslavia 52,121.
Semimanufactures	123,358	139,145	3,159	West Germany 56,657; France 22,333; Belgium-Luxembourg 11,412.
Antimony:				
Ore and concentrate	57	20	20	
Oxides	893	1,163	15	Belgium-Luxembourg 517; United Kingdom 243; France 167.
Metal including alloys, all forms	247	221	(2)	Turkey 93; Netherlands 69; Belgium-Luxembourg 14.
Arsenic: Oxides and acids	454	534	--	France 176; Belgium-Luxembourg 142; West Germany 72.
Beryllium:				
Oxides and hydroxides	23	25	(2)	France 24; United Kingdom 1.
Metal including alloys, all forms	(2)	(2)	(2)	
Bismuth: Metal including alloys, all forms	89	110	--	United Kingdom 74; West Germany 18; Netherlands 8.
Cadmium: Metal including alloys, all forms	54	96	1	Netherlands 47; Belgium-Luxembourg 21; Finland 6.
Cesium and rubidium: Metal including alloys, all forms	7	10	--	Austria 7; United Kingdom 3.
Chromium:				
Ore and concentrate	229,118	152,169	--	Albania 63,840; Republic of South Africa 43,240; Turkey 19,632.
Oxides and hydroxides	2,050	2,958	815	West Germany 1,432; United Kingdom 375.
Metal including alloys, all forms	193	198	1	United Kingdom 82; France 43; China 34.
Cobalt:				
Ore and concentrate	3	--		
Oxides and hydroxides	230	235	(2)	Belgium-Luxembourg 163; Finland 36; West Germany 21.
Metal including alloys, all forms	415	620	5	West Germany 116; France 102; United Kingdom 80.
Columbium and tantalum: Metal including alloys, all forms:				
Columbium (niobium)	2	34	28	Netherlands 2; Republic of South Africa 2.
Tantalum	4	3	2	West Germany 1.
Copper:				
Ore and concentrate	24	1	--	All from Zambia.
Matte and speiss including cement copper	683	188	--	France 106; Belgium-Luxembourg 52; Switzerland 15.
Oxides and hydroxides	299	342	3	West Germany 136; Norway 128; Belgium-Luxembourg 53.
Sulfate	2,719	380	--	France 298; Czechoslovakia 80; Netherlands 1.
Ash and residue containing copper	7,367	6,428	--	Austria 3,282; Albania 2,974; Belgium-Luxembourg 76.
Metal including alloys:				
Scrap	120,860	145,098	37,181	United Kingdom 32,508; France 31,426.
Unwrought	363,440	369,967	1,674	Chile 128,112; Zambia 43,921; Belgium-Luxembourg 32,758.
Semimanufactures	145,503	155,596	332	West Germany 55,216; France 49,994; Belgium-Luxembourg 12,627.
Germanium: Metal including alloys, all forms	84	1	(2)	Mainly from Belgium-Luxembourg.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Gold:				
Waste and sweepings value, thousands	--	$1	--	All from Cyprus.
Metal including alloys, unwrought and partly wrought thousand troy ounces	7,458	6,985	96	Republic of South Africa 3,651; Switzerland 2,454; U.S.S.R. 312.
Hafnium: Metal including alloys, all forms	(2)	(2)	(2)	Mainly from France.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	18,294	17,600	--	Brazil 5,939; Liberia 3,322; Mauritania 2,253.
Pyrite, roasted do	(2)	(2)	--	Mainly from Gabon.
Metal:				
Scrap do	5,777	4,746	314	West Germany 1,731; France 1,358; U.S.S.R. 692.
Pig iron, cast iron, related materials	351,494	471,042	593	U.S.S.R. 86,320; Brazil 71,778; France 70,760.
Ferroalloys:				
Ferrochromium	97,833	99,030	11	Republic of South Africa 39,049; Zimbabwe 24,018; Finland 11,890.
Ferromanganese	81,823	90,052	--	France 38,579; Republic of South Africa 24,783; Norway 8,437.
Ferromolybdenum	1,500	1,979	--	Belgium-Luxembourg 836; Austria 549; Netherlands 310.
Ferronickel	22,085	21,719	--	France 9,654; Colombia 4,787; Dominican Republic 3,645.
Ferrosilicochromium	1,114	1,826	--	West Germany 1,801; Belgium-Luxembourg 25.
Ferrosilicomanganese	27,008	23,545	--	Norway 10,300; Republic of South Africa 5,267; Portugal 2,390.
Ferrosilicon	48,133	55,361	--	West Germany 15,772; France 14,718; Norway 12,483.
Silicon metal	13,349	14,145	(2)	Norway 5,372; France 3,451; West Germany 1,681.
Unspecified	6,338	8,412	13	France 3,416; United Kingdom 1,275; West Germany 970.
Steel, primary forms thousand tons	2,971	3,356	13	France 851; Belgium-Luxembourg 488; Brazil 358.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	1,035	1,184	13	France 278; West Germany 236; Switzerland 119.
Universals, plates, sheets do	1,594	1,771	37	France 394; Belgium-Luxembourg 318; West Germany 242.
Hoop and strip do	206	195	(2)	West Germany 65; France 62; Austria 17.
Rails and accessories do	78	62	(2)	Netherlands 19; Canada 18; West Germany 12.
Wire do	94	84	(2)	Yugoslavia 26; Belgium-Luxembourg 24; France 9.
Tubes, pipes, fittings do	341	366	5	West Germany 123; France 92; United Kingdom 27.
Castings and forgings, rough do	14	17	(2)	Spain 5; France 4; West Germany 4.
Lead:				
Ore and concentrate	12,019	30,945	--	Canada 10,267; Spain 7,560; Australia 5,270.
Oxides	1,762	711	12	West Germany 559; Netherlands 95; United Kingdom 40.
Ash and residue containing lead	4,237	1,286	--	West Germany 688; Switzerland 236; Cyprus 185.
Metal including alloys:				
Scrap	12,763	18,122	57	Switzerland 9,180; Austria 2,239; France 2,062.
Unwrought	114,995	140,804	150	West Germany 30,618; Morocco 26,311; Mexico 19,182.
Semimanufactures	774	984	2	Belgium-Luxembourg 367; West Germany 264; France 140.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Lithium:				
Oxides and hydroxides	298	267	5	West Germany 171; United Kingdom 23; Netherlands 17.
Metal including alloys, all forms	6	3	3	
Magnesium: Metal including alloys:				
Scrap	1,662	877	13	West Germany 324; Netherlands 212; France 105.
Unwrought	2,519	1,601	--	Norway 753; France 543; Belgium-Luxembourg 90.
Semimanufactures	754	752	62	France 550; West Germany 50.
Manganese:				
Ore and concentrate, metallurgical-grade	392,646	329,736	9,000	Gabon 175,622; Republic of South Africa 111,479; France 9,006.
Oxides	2,417	2,499	2	Belgium-Luxembourg 1,358; France 448; Netherlands 328.
Metal including alloys, all forms	3,521	1,836	1	Republic of South Africa 725; Netherlands 247; West Germany 217.
Mercury 76-pound flasks	4,930	5,197	58	Netherlands 2,755; United Kingdom 754; West Germany 667.
Molybdenum:				
Ore and concentrate	4,810	2,742	162	Netherlands 1,496; Luxembourg 453; Chile 374.
Oxides and hydroxides	65	65	11	West Germany 45; United Kingdom 5.
Metal including alloys:				
Scrap	(2)	35	--	All from France.
Unwrought	29	75	2	Austria 48; West Germany 19; United Kingdom 5.
Semimanufactures	113	155	91	Austria 42; France 6.
Nickel:				
Ore and concentrate	118	7	--	All from France.
Matte and speiss	4,426	4,927	--	Australia 3,425; Cuba 584; Netherlands 528.
Oxides and hydroxides	975	1,836	--	Cuba 1,193; Austria 438; Australia 117.
Ash and residue containing nickel	8,545	3	--	All from France.
Scrap	270	86	6	West Germany 38; France 19; United Kingdom 11.
Unwrought	17,919	18,387	314	U.S.S.R. 3,292; Canada 2,957; Netherlands 2,594.
Semimanufactures	3,039	2,812	286	West Germany 1,053; United Kingdom 732.
Platinum-group metals:				
Waste and sweepings value, thousands	$4,001	$9,295	$3,816	Yugoslavia $3,450; Egypt $708.
Metal including alloys, unwrought and partly wrought troy ounces	202,358	237,274	9,517	United Kingdom 76,648; Switzerland 48,548; Republic of South Africa 15,432.
Rare-earth metals including alloys, all forms	16	65	1	Brazil 42; Austria 16; France 2.
Rhenium: Metal including alloys, all forms	(2)	(2)	(2)	
Selenium, elemental	290	34	3	West Germany 7; Japan 7; United Kingdom 7.
Silicon, high-purity	7	20	(2)	Switzerland 15; Belgium-Luxembourg 3.
Silver:				
Waste and sweepings value, thousands	$3,556	$3,521	$805	France $1,424; Switzerland $1,146.
Metal including alloys, unwrought and partly wrought thousand troy ounces	8,842	18,667	129	Switzerland 8,594; West Germany 2,726; United Kingdom 2,582.
Tellurium, elemental and arsenic	59	65	--	Sweden 63; Belgium-Luxembourg 1; Canada 1.
Tin:				
Ore and concentrate	--	24	--	All from West Germany.
Oxides	28	21	--	Czechoslovakia 20; West Germany 1.
Ash and residue containing tin	12	15	--	All from France.
Metal including alloys:				
Scrap	5	9	--	France 5; Gibraltar 4.
Unwrought	5,636	6,330	5	Malaysia 2,339; Indonesia 2,031; United Kingdom 593.
Semimanufactures	245	253	1	West Germany 150; United Kingdom 40; Singapore 33.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Titanium:				
Ore and concentrate	146,179	54,848	18	Canada 36,514; Australia 16,041; Republic of South Africa 2,136.
Oxides	29,601	28,712	30	West Germany 13,976; United Kingdom 3,781; France 2,507.
Metal including alloys:				
Scrap	2,481	2,911	1,198	Austria 1,474; Netherlands 76.
Unwrought	75	67	1	U.S.S.R. 25; United Kingdom 21; West Germany 16.
Semimanufactures	453	495	108	Japan 132; West Germany 60.
Tungsten:				
Ore and concentrate	181	144	18	Canada 74; Austria 23.
Oxides and hydroxides	26	46	--	Austria 45; West Germany 1.
Metal including alloys:				
Scrap	1	1	--	All from West Germany.
Unwrought	39	35	9	United Kingdom 9; France 6.
Semimanufactures	91	110	15	West Germany 24; United Kingdom 21.
Uranium and thorium:				
Ore and concentrate	67	56	--	France 23; Chile 18; West Germany 14.
Metal including alloys, all forms:				
Uranium	18	2	(2)	Mainly from West Germany.
Thorium	1	(2)	--	All from West Germany.
Vanadium:				
Ore and concentrate	--	1,208	--	Greece 1,200; United Kingdom 8.
Oxides and hydroxides	30	15	--	Netherlands 13; West Germany 2.
Ash and residue containing vanadium	2,508	2,178	--	Austria 1,752; France 227; West Germany 199.
Metal including alloys:				
Scrap	8	23	--	All from West Germany.
Unwrought	27	50	1	Belgium-Luxembourg 39; West Germany 5.
Semimanufactures	(2)	18	--	France 11; Belgium-Luxembourg 7.
Zinc:				
Ore and concentrate	395,978	443,572	--	Ireland 116,817; Canada 76,702; Peru 68,568.
Oxides	5,048	5,552	--	West Germany 1,902; France 962; Belgium-Luxembourg 788.
Blue powder	1,716	2,094	--	West Germany 776; France 556; Norway 505.
Matte	12,230	11,805	73	West Germany 3,669; France 2,982; United Kingdom 1,041.
Ash and residue containing zinc	6,483	5,821	--	West Germany 5,032; Switzerland 334; Tunisia 142.
Metal including alloys:				
Scrap	10,563	8,237	--	France 4,178; West Germany 2,010; Switzerland 581.
Unwrought	78,350	68,565	--	West Germany 26,712; Netherlands 12,616; Belgium-Luxembourg 8,995.
Semimanufactures	4,203	4,851	--	West Germany 3,334; France 533; Belgium-Luxembourg 498.
Zirconium:				
Ore and concentrate	84,627	48,175	--	Australia 36,850; Republic of South Africa 10,822; West Germany 281.
Metal including alloys:				
Scrap	7	15	--	France 10; West Germany 5.
Unwrought	4	25	--	Republic of South Africa 20; France 5.
Semimanufactures	49	33	19	United Kingdom 10; West Germany 3.
Other:				
Ores and concentrates	1,655	10,273	--	Canada 7,421; China 2,516; Denmark 242.
Oxides and hydroxides	369	904	3	Belgium-Luxembourg 391; West Germany 359; United Kingdom 265.
Ashes and residues	99,229	96,080	120	Republic of South Africa 64,966; Canada 20,761; Hungary 2,705.
Base metals including alloys, all forms	144	3	(2)	United Kingdom 2.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	3,782	6,820	101	Greece 4,779; Turkey 459; Spain 166.
Artificial:				
Corundum	33,778	32,268	465	West Germany 8,824; Austria 8,376; Yugoslavia 4,930.
Silicon carbide	12,468	10,191	(2)	Norway 3,391; West Germany 2,003; Switzerland 1,650.
Dust and powder of precious and semi-precious stones including diamond kilograms	2,729	3,185	650	Switzerland 1,311; Ireland 767.
Grinding and polishing wheels and stones	4,240	4,531	23	Austria 1,456; France 777; West Germany 617.
Asbestos, crude	47,952	47,895	109	Canada 23,668; Zimbabwe 8,176; Republic of South Africa 5,246.
Barite and witherite	19,388	24,615	--	Spain 9,669; Turkey 3,600; Morocco 3,331.
Boron materials:				
Crude natural borates	121,375	116,854	--	Turkey 115,899; Belgium-Luxembourg 800; France 89.
Elemental	(2)	(2)	(2)	
Oxides and acids	3,839	6,592	320	Turkey 4,531; France 1,218.
Bromine	1,614	2,613	--	Israel 2,585; France 24; Hungary 4.
Cement	381,461	319,451	74	Yugoslavia 243,111; France 66,833; Spain 3,264.
Chalk	27,649	9,717	--	France 9,506; West Germany 115; Austria 94.
Clays, crude:				
Bentonite	20,731	31,615	50	Greece 23,520; West Germany 1,914; United Kingdom 1,026.
Chamotte earth	64,681	61,090	1,684	France 36,890; Czechoslovakia 12,038; West Germany 4,897.
Fuller's earth	NA	2,575	1,019	Spain 1,507; Netherlands 25.
Kaolin	635,996	617,612	122,707	United Kingdom 284,693; West Germany 53,871.
Unspecified	936,110	951,724	422	West Germany 773,583; France 104,686; United Kingdom 51,440.
Cryolite and chiolite	814	873	--	Denmark 696; West Germany 171; Netherlands 6.
Diamond:				
Gem, not set or strung carats	218,458	222,122	NA	Belgium-Luxembourg 105,267; India 39,661; Israel 38,763.
Industrial stones do	187,880	153,921	--	Belgium-Luxembourg 145,366; United Kingdom 5,284.
Diatomite and other infusorial earth	5,044	8,916	220	France 7,887; United Kingdom 251; Spain 250.
Feldspar, fluorspar, related materials:				
Feldspar	12,423	7,119	434	West Germany 3,188; Sweden 1,884; France 1,171.
Fluorspar	91,645	82,274	--	Spain 39,628; France 16,441; Mexico 8,000.
Unspecified	13,936	22,046	--	Norway 10,635; Canada 8,079; Sweden 1,548.
Fertilizer materials:				
Crude, n.e.s	2,711	3,009	132	France 1,455; West Germany 847; Israel 293.
Manufactured:				
Ammonia	160,482	105,938	--	U.S.S.R. 64,052; Yugoslavia 26,057; Austria 11,623.
Nitrogenous	274,265	364,585	168	Saudi Arabia 100,475; Libya 74,675; Austria 52,978.
Phosphatic	211,590	209,634	--	Tunisia 64,535; Israel 60,729; Iraq 32,147.
Potassic	647,695	696,732	130	Israel 223,808; West Germany 95,863; East Germany 92,562.
Unspecified and mixed	716,680	871,451	333,705	Jordan 124,708; Tunisia 120,874.
Graphite, natural	5,955	6,867	7	Brazil 2,118; West Germany 1,716; Austria 1,187.
Gypsum and plaster	13,443	15,469	2,847	West Germany 8,550; France 3,046.
Iodine	538	557	1	Japan 336; Chile 147; Netherlands 56.
Kyanite and related materials	41,159	22,754	696	Republic of South Africa 12,156; Spain 5,224; West Germany 1,596.
Lime	3,115	4,830	--	Yugoslavia 4,222; West Germany 440; France 105.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Magnesium compounds:				
Magnesite	20,266	12,720	--	Greece 12,067; Albania 480; France 74.
Oxides and hydroxides	79,027	81,008	159	Greece 21,232; Austria 14,989; China 12,628.
Other	3,117	3,587	--	West Germany 3,137; East Germany 450.
Mica:				
Crude including splittings and waste	1,510	1,095	194	France 380; Austria 180.
Worked including agglomerated splittings	543	509	3	Belgium-Luxembourg 169; France 120; West Germany 100.
Nitrates, crude	402	680	--	Belgium-Luxembourg 298; Netherlands 242; Austria 48.
Phosphates, crude thousand tons	1,296	1,389	108	Morocco 573; Israel 295; Syria 130.
Phosphorus, elemental	94	319	--	France 114; Romania 109; United Kingdom 96.
Pigments, mineral:				
Natural, crude	314	270	--	Cyprus 126; Spain 114; France 24.
Iron oxides and hydroxides, processed	20,404	21,824	331	West Germany 14,913; France 2,769; Belgium-Luxembourg 1,602.
Potassium salts, crude	9,090	7,112	--	France 6,097; West Germany 915; Belgium-Luxembourg 99.
Precious and semiprecious stones other than diamond:				
Natural kilograms	77,083	105,621	114	Brazil 66,622; West Germany 10,329; Thailand 638.
Synthetic do	6,675	10,451	NA	West Germany 2,330; Thailand 1,901; Switzerland 1,882.
Pyrite, unroasted	167,574	158,970	--	Cyprus 65,045; Norway 54,988; U.S.S.R. 19,835.
Quartz crystal, piezoelectric kilograms	629	505	NA	NA.
Salt and brine	943,874	934,151	26	Netherlands 420,957; France 256,218; Tunisia 128,421.
Sodium compounds, n.e.s.: Carbonate, manufactured	30,744	28,986	--	Switzerland 10,175; Yugoslavia 9,337; Romania 4,751.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	971,585	960,469	8,282	Spain 268,734; Brazil 126,493; Finland 121,286.
Worked	9,386	11,534	2	Greece 2,646; Yugoslavia 2,040; Spain 1,547.
Dolomite, chiefly refractory-grade	2,063	2,370	(2)	West Germany 1,107; Netherlands 494; France 378.
Gravel and crushed rock	14,752	17,112	19	France 13,001; Yugoslavia 1,828; West Germany 886.
Limestone other than dimension	503	774	--	All from West Germany.
Quartz and quartzite	83,622	93,146	73	Switzerland 34,174; Spain 27,816; Greece 11,445.
Sand other than metal-bearing	1,006,583	896,858	1,728	France 553,971; Belgium-Luxembourg 112,692; West Germany 101,802.
Sulfur:				
Elemental:				
Crude including native and by-product	399,495	337,251	50	Canada 102,541; Saudi Arabia 73,243; Poland 64,472.
Colloidal, precipitated, sublimed	1,215	1,325	--	West Germany 830; Yugoslavia 271; France 174.
Dioxide	(2)	25	--	West Germany 18; Austria 6.
Sulfuric acid	29,870	28,269	27	Spain 15,546; Yugoslavia 6,008; Austria 5,145.
Talc, steatite, soapstone, pyrophyllite	24,963	28,464	60	Austria 15,546; France 5,154; Spain 2,232.
Vermiculite, perlite, chlorite	40,996	33,489	--	U.S.S.R. 11,292; Greece 10,147; Republic of South Africa 7,722.
Other:				
Crude	34,133	46,494	1,946	U.S.S.R. 13,287; Spain 10,144; West Germany 5,818.
Slag and dross, not metal-bearing	7,269	8,091	--	France 2,042; West Germany 1,753; Switzerland 1,416.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,059	795	608	West Germany 186.
Carbon:				
Carbon black	14,024	6,476	147	Netherlands 1,543; United Kingdom 899; U.S.S.R. 689.
Gas carbon	20,129	17,898	840	France 10,268; West Germany 3,592; Netherlands 1,024.
Coal:				
Anthracite thousand tons	674	884	302	Republic of South Africa 489; U.S.S.R. 49.
Bituminous do.	20,125	19,063	8,910	Republic of South Africa 4,962; Australia 2,068.
Briquets of anthracite and bituminous coal do.	71	239	--	Republic of South Africa 115; Colombia 114; France 2.
Lignite including briquets do.	148	59	(2)	West Germany 50; East Germany 5; Yugoslavia 4.
Coke and semicoke do.	135	154	10	France 66; West Germany 39; Belgium-Luxembourg 16.
Gas, natural: Gaseous million cubic feet	751,707	760,560	--	Algeria 306,775; U.S.S.R. 297,373; Netherlands 155,611.
Peat including briquets and litter	140,589	180,023	82	West Germany 120,760; U.S.S.R. 26,495; Netherlands 18,066.
Petroleum:				
Crude thousand 42-gallon barrels	480,662	533,926	--	Saudi Arabia 111,428; Libya 107,965; U.S.S.R. 50,076.
Refinery products:				
Liquefied petroleum gas do.	19,670	NA		
Gasoline do.	24,609	23,257	37	Kuwait 4,165; Libya 3,251; Yugoslavia 2,270.
Mineral jelly and wax do.	369	246	5	Hungary 60; West Germany 55; Netherlands 22.
Kerosene and jet fuel do.	529	1,889	3	West Germany 798; Libya 432; Turkey 170.
Distillate fuel oil do.	47,242	37,049	(2)	Romania 13,375; Kuwait 5,321; Algeria 5,263.
Lubricants do.	877	1,221	21	France 348; Greece 228; West Germany 174.
Residual fuel oil do.	129,204	124,435	--	U.S.S.R. 23,052; Kuwait 21,446; Saudi Arabia 9,426.
Bitumen and other residues do.	2,359	2,174	1,481	Spain 329; Yugoslavia 198.
Bituminous mixtures do.	12	14	1	France 9; Sweden 2; United Kingdom 1.
Petroleum coke do.	13,187	13,656	12,126	U.S.S.R. 649; United Kingdom 334.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Copper.—The Italian metal group Società Metallurgica Italiana (SMI), and Pechiney, the French metals conglomerate, agreed to merge their copper-processing activities into a joint company named Europeene de Metallurgie. Under the mechanics of the merger, Trafilerie e Laminatoi di Metalli (TLM), owned 60% by Pechiney, was the hub of the transaction. Specifically, SMI acquired 30% of TLM's capital from Pechiney. TLM then absorbed Pechiney's French copper subsidiary Trefimetaux and SMI's copper subsidiary La Metalli Industriale (LMI), of which SMI was a 57% shareholder. Upon completion of the deal, Pechiney and SMI retained 51% of TLM capital, with SMI holding a greater share. The accord also provided that, although daily operations would be controlled by SMI, strategic decisions would be made jointly. It was expected that the added capital strength of the new company would allow the enterprise to

focus on production and sales aimed at growth areas such as electronics and telecommunications. Moreover, its output could amount to 20% of the European market, making it Europe's leading copper processor.

Ferroalloys.—Indel, the Italian silicon metal and ferrosilicon producer, acquired a majority stake in Società Italiana per il Magnesio e Leghe di Magnesio (IMLM). Previously owned by the Sacchariferous Montesi Group, IMLM planned to concentrate its activities on the production of ferromagnesium alloys for automobile and construction applications.

Iron and Steel.—Finanziaria Siderugica S.p.A. (Finsider), Italy's Government-owned steelmaker, lost $1.4 billion over the 18-month period that ended in September 1987. Reasons for the loss included a reduction in selling prices of 15% to 25%, an 11% rise in imports, and a concomitant reduction in domestic steel demand. Particularly noteworthy was the 30% decline in demand by the oil market for drill pipe manufactured by Dalmine S.p.A., a Finsider subsidiary.

A major consequence of the Finsider's financial losses was a reduction in the equity component of the company's capital structure. In addition, Finsider reportedly planned to cut allocations to its long-products division, New Deltasider, by $156.5 million; to its weldless pipe division, Dalmine, by $54.8 million; and to its stainless and magnetic steel division, Terni, by $46.9 million. The steelmaker also sought to reduce its work force by 22,000 by eliminating 4,500 jobs at its Taranto coil plant, and by closing its steel mill at Bagnoli, 120 kilometers northwest of Naples.

The EEC Commission approved a joint venture of public- and private-sector steelmakers to produce semimanufactures at the former Italsider Cornigliano works in Genoa. Mechanics of the joint venture involved the transfer of majority ownership of the Cornigliano operating company, Cogea, from Italsider to the private sector-firms, Bellicini, Leali, Luccini, Regis, Riva, and Sassone. In the process, those companies scrapped their raw steelmaking plants and their combined annual capacity of 2.22 million tons. They planned to take their supply of semimanufactures from Cogea, with a view toward meeting the EEC annual capacity goal of 1.4 million tons. Each of Cogea's owners was to take blooms and billets proportionate to the following ownership shares: Leali, 22%; Riva, 17.2%; Dalmine, 14%; Italsider, 12.4%; Regis, 11.5%; Lucchini, 9.3%; Deltasider, 6%; Sassone, 5.8%; and Bellicini, 1.8%.

FIT Ferrotubi requested written bids from prospective buyers to acquire its seamless pipe works at Sestri Levante and its smelting and continuous casting operations at Riva Trigoso. Prominent among the prospective suitors was the Marcegaglia group, which put forth a plan to restart production of FIT's works. Specifically, the Sestri Levante works was to be opened, repaired, and renovated. Work on Riva Trigoso was scheduled to commence later. In the interim, Marcegaglia undertook a study to determine the manner in which the acquisition would proceed, based on expected capital outlays and production efficiencies.

Lead.—SAMIM's Kivcet lead smelter at Porto Vesme, Sardinia, commenced operations. The smelter was scheduled to produce lead bullion at its capacity of 80,000 tons per year from 125,000 tons of lead concentrate purchased from European, South African, North American, and Peruvian sources. The Kivcet plant added annual capacity of 105,000 tons of lead to SAMIM's Sardinian operation. It was the last step in the company's reorganization of its production operations in the Porto Vesme area.

Zinc.—In 1987, Petrosula Sud, owned 51% by France's Penarroya, and 49% by the Italian state-owned company, lost $46.9 million on revenues of $95 million. Consequently, it was contemplating suspension of payments to creditors. Although the company's output of 100,550 tons of zinc reflected production at levels over capacity, its operating costs were prohibitively high as a result of obsolete equipment. Petrosula planned to modernize the plant with a view toward greater cost efficiencies, but its capital was insufficient to permit the necessary investment of $78.2 million. The situation was further complicated by the need for an additional $39.1 million to support sales. Moreover, Penarroya reportedly was not prepared to make the capital outlays necessary for renovation. The French company was seeking to sell its interest to another party. Closure of the facility was expected to result in the loss of 1,000 jobs because of smelter overcapacity in Western Europe.

INDUSTRIAL MINERALS

Cement.—Iri-Finsider, the Italian-state steel group was selling its 51% share in

Cementerie del Tirrano SPA (Cementir) reportedly for $142.5 million to Colacem. The sum reflects the asset value of the company's six cement works. Cementir made a net profit of $23.7 million on revenues of $195.7 million. Annual output from Cementir amounted to 1.4 million tons of portland cement, 1.14 tons of blast furnace cement, and 1.34 tons of portland slag and pozzolanic cement combined.

Italcementi, the largest of Italy's 50 cement producers, announced profits of $83.1 million during the first half of 1987, a 29% increase over the same period in 1986. Its market share in Italy accounted for 35.7% of the whole. The increases reflected a 43% rise in domestic demand for cement; demand by concrete manufacturers rose 38.7%, and demand by the construction and manufacturing industries rose 33.1%. The increased sales benefited the producing regions of Lombardy, Sicily, Veneto, Puglia, and Piemonte, with output tonnages of 4.7 million, 3.7 million, 3.0 million, 2.7 million, and 2.6 million, respectively.

Fluorspar.—The Gennas Tres Montis and Muscadroxia Mines, owned by Mineraria Silius, produced 78,300 tons of acid-grade fluorspar from crude ore extracted, representing more than 90% of national production. Minerararia Silius undertook a reorganization plan that was expected to cut costs with new equipment that would permit higher output per hour from the company's human and material resources.

Sulfur.—A pilot plant for the EEC's Inspira Mark 13 desulfurization process was being constructed at the Saras refinery in Sarroch, Sardinia. The installation had a nominal flue gas capacity of 32,000 cubic meters per hour and a concentrated sulfuric acid production capacity of 5 tons per day. The process was a result of development work undertaken at the EEC's Joint Research Center in Ispra near Milan. Ferlini Technology was the prime contractor but process design, construction and startup supervision were subcontracted to Kraftlanglogen Heidelberg. The 2-year test was to begin in early 1988.

Talc.—About one-half of the Italian output of talc was mined by Talco e Grafite Val Chisone S.p.A., which operated two underground mines at Fontane in the western Alps and Orani in Sardinia. The western Alps deposits, 65 kilometers northwest of Pinerolo, were formed by hydrothermal alteration and low metamorphic replacement of dolomite set in gneisses and mica schists. The talc occurred as veins running underground at depths between 200 and 500 meters.

The ore was mined in horizontal descending strips to ensure that only high-purity material was extracted. It was also handsorted at the surface. Annual mining capacity was 45,000 tons. The mined material was transported 35 kilometers to two milling plants on the Chisone River near Pinerolo. The ore was crushed, screened to 12 millimeters, and dried in rotary kilns before final grinding.

Much of the material was pulverized in high-speed vertical mills to produce grades with a particle size of 30, 20, and 10 micrometers. Total annual capacity of the grinding plant was 80,000 tons.

Industria Mineraria Italiana modernized its talc operations. Reportedly, the company increased the annual output of its Pra Mosia Mine to between 85,000 and 90,000 tons. In addition, it modernized machinery and planned to increase production of pulverized talcs at its Torre Santa Maria plant, where annual capacity was 60,000 tons. The bulk of the 45,000 tons of talc produced in 1987 was sold to the paper, paint, plastics, and rubber industries. Forty percent of that output was exported to Austria, France, the Federal Republic of Germany, and Switzerland.

Zeolite.—Industria Chimica Carlo Laviosa S.p.A. and Rhône-Poulenc Chimica S.p.A. established a joint-venture company, Laviosa Rhône-Poulenc S.p.A., to construct a synthetic zeolite plant near the new company's headquarters at Leghorn on the west coast of Italy. Capital outlays for the venture were said to amount to $3.1 million. Annual output for the new plant was expected to be 30,000 tons of detergent-grade zeolite A, targeted primarily to Italy's domestic market. Operations were scheduled to begin in spring 1988.

MINERAL FUELS

Coal.—It was expected that output at Ente Nazionale Elettrica's (ENEL) Santa Barbara Mine in Tuscany, the Pietrafitta Mine in Umbria, and the company's other open pit lignite mines would increase with increases in coal usage projected by ENEL. The company's study estimated ENEL's coal use would increase from 10 million metric tons to 25 million metric tons by 1995. With a national referendum not to proceed with nuclear-powered electricity plants, ENEL planned to construct coal-

powered plants between 1991 and 1995 at Brindisi Sud, Gioia Tauro, Pietrafitta, and Tarazzano.

Petroleum.—AGIP signed an agreement with Algeria's Société Nationale pour la Recherche, la Production, le Transport, la Transformation et la Commercialisation des Hydrocarbures (SONATRACH) to develop the Rom Oilfield, discovered by AGIP in the Sahara Desert, 200 kilometers from the Tunisian border and 700 kilometers from the Mediterranean coast.

The agreement pertained to Block 400 of the Rom Oilfield and stipulated that AGIP would recover, via production, 100% of the exploration costs incurred to the time of the agreement. Reportedly, AGIP also would begin drilling a second well in March 1988 and would explore the untapped areas of Block 403 to determine the presence of other deposits. Investments related to developing the deposit were to be made by both partners in a joint venture formed by AGIP and SONATRACH.

Production at Block 400 was scheduled to begin in 1990, and was expected to reach 30,000 barrels per day. Output from the deposit, situated at a depth of 3,300 meters, was to be transported to the Algerian coast by SONATRACH.

Saipem S.p.A., a subsidiary of Italy's ENI group, entered into a joint venture with the British firm of Brown and Root Inc., each with a 50% interest, to form a new corporation, European Marina Contractors (EMC) for the purpose of installing and marketing gas and oil pipelines in the North Sea. The new enterprise planned to limit its client base to northern Europe, principally the British Isles and Scandinavia. EMC had secured contracts to lay 60 kilometers of pipeline in the North Sea for Amerada Hess Corp., valued at $13.7 million, and an additional 55 kilometers for Shell Tern-Eider, a Royal Dutch/Shell subsidiary, valued at $12.5 million EMC was then expected to be a major player in two major projects between 1989 and 1992: the new system for undersea transport of British natural gas, and the construction of 1,000-kilometer natural-gas maxipipeline that will carry methane from Norway's offshore fields to continental Europe.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Italian lira (Lit) to U.S. dollars, at the rate of Lit1,277 = US$1.00, the average rate in 1987.

The Mineral Industry of Japan

By John C. Wu[1]

The mining sector of Japan's mineral industry continued to suffer from high production costs, depleting ore reserves, and increased imports of low-priced minerals and metals resulting from further appreciation of the Japanese yen in 1987. According to the Ministry of International Trade and Industry (MITI), the output of the mining industry declined 9% from that of 1986 because of fewer operating mines.

The number of operating mines for metals and industrial minerals declined to 34 and 598 from 52 and 608, respectively, in 1986. The number of employees in metals and industrial minerals mines decreased to 3,579 and 14,088 from 7,743 and 14,891, respectively, in 1986.[2] The following mines were closed in 1987: February, the Hosokura lead-zinc mine in Miyagi by Hosokura Mining Co. Ltd.; March, the Akenobe copper-tin-zinc mine in Hyogo by Akenobe Mining Co. Ltd., and the Syakanai copper-lead-zinc mine in Akita by Syakanai Mining Co. Ltd.; and September, the Nakatatsu lead-zinc mine in Fukui by Nippon Zinc Mining Co. Ltd.

Despite reduced output of domestic ore, production of most nonferrous metals, except zinc, increased by importing more raw materials to meet a stronger domestic demand. Zinc production failed to rebound owing to a substantial decline in domestic output of zinc ore. Production of primary aluminum dropped to a new low since 1952 because of increased imports. Production of iron and steel increased slightly despite a further decline in exports and increased imports in 1987.

A construction boom stimulated by public works projects in the second half of 1987 not only created a stronger domestic demand for steel and nonferrous metals but also helped the mineral processing sector from further decline. Because of stronger domestic demand and increased domestic prices of iron and steel products and nonferrous metals, most steelmakers and nonferrous metal producers reportedly returned to a profitable position and delayed further reductions of production facilities and employment.

In the industrial minerals sector, production of limestone rebounded because of increased construction. However, cement production failed to recover due to a further decline in exports and increased imports of low-priced foreign cement. The cement industry is expected to scale down its annual capacity by 12 million tons to 86 million tons to survive keen competition from the Republic of Korea and Taiwan. The nitrogen fertilizer industry continued to scrap its excess capacity. Production of urea declined considerably because of low price and increased imports.

In the mineral fuels sector, Japan's coal output dropped to a historical low. In line with the Eighth National Coal Policy, the Sunagawa Mine in Hokkaido was closed permanently in July by Mitsui Coal Mining Co. Ltd. and the Mayachi Mine, also in Hokkaido, in October by Hokutan Mayachi Coal Mining Co. Ltd. Other major coal producers also cut back production and employment. As a result, the number of employees in the coal mining industry decreased to 9,167 from 12,906 in 1986. In petroleum refining, the industry continued to scale down its facilities for producing heavy fuel oil. It was expected to upgrade and modernize production facilities for higher value-added products.

In 1987, Japan was the world's largest producer of cadmium metal, iodine, and

selenium metal; the second largest producer of indium, gallium, steel, and zinc metals; the third largest producer of refined copper, limestone, refined nickel, and titanium sponge metal. Japan remained the world's largest importer of coal, copper concentrate, iron ore, nickel ore, liquefied natural gas (LNG), phosphate rock, and industrial salt. Japan was the world's second largest importer and consumer of crude petroleum.

Despite the adverse effect of further appreciation of the yen on growth of the export-oriented economy, the Japanese economy grew 4.2% compared with 2.4% (revised) in 1986. According to the Economic Planning Agency, the higher growth in 1987 was attributed mainly to an expansion in domestic demand spurred by the implementation of a $41.5 billion[3] Government spending package to stimulate the economy. Private housing starts, public-works spending, and corporate investment in plant and equipment all showed a sharp increase in 1987. As a result of the 4.2% rise in the output of goods and services, Japan's gross national product (GNP) in 1980 constant dollars reached $2,154 billion and per-capita GNP rose to $19,642. In 1987, per-capita GNP of the United States was $18,403.

The impact of the Japanese yen on merchandise trade continued to show a decline in exports and a rise in imports in volume terms. However, because of a 14% yen appreciation in 1987, exports rose to $229 billion from $209 billion in 1986, while imports increased to $149 billion from $126 billion in 1986. As a result, Japan's merchandise trade surplus declined only 3.6% to $80 billion in 1987.

Government Policies and Programs.—To expand domestic demand and reduce the external trade surplus, the Government adopted a package of "Emergency Economic Measures" in May. The $41.5 billion package included $22.5 billion for Central Government investment projects, $1.7 billion for public-enterprise investment, $5.5 billion for local government public works, $7 billion for income tax reduction, and $4.8 billion of additional funding in public lending for housing construction. Most funding for the package reportedly will come from selling the Government's share of Nippon Telegraph and Telephone, to be carried out over a 4-year period beginning in 1987, and issuing Government bonds.

In July, the Metal Mining Agency of Japan (MMAJ) announced that a final agreement was reached between Japan and China for joint exploration and feasibility studies for 15 rare metal minerals in China over a 5-year period beginning in August 1987. The joint project included geological surveys, physical prospecting, core sampling, and exploratory drilling in northwest Heilongjiang Province near Harbin for chromium, cobalt, copper, lead, molybdenum, nickel, silver, and vanadium and along the coast of Leizhou Peninsula near Yangjiang in southwest Guangdong Province for columbium, hafnium, rare earths, tantalum, titanium, and zirconium. Funding for the $17 million project was provided by the Japan International Cooperation Agency.[4]

Japan's stockpile of chromium, cobalt, manganese, molybdenum, nickel, tungsten, and vanadium reached 31.4-day supply by the end of its fiscal year 1987. In 1987, MMAJ, the administrator of the stockpile program, changed the three-facet stockpile program to two, national and private, to reduce Government expenditures and allow more private companies to participate. Under this new program, MMAJ continued to administer the national program for maintaining national economic stability in the event of a medium- or long-term supply disruption. The Japan Rare Metal Association managed the private program for maintaining market stability in the event of short term supply disruptions. At the end of fiscal year 1987, the national stockpile had a 22-day supply and the private stockpile had a 9.4-day supply.

PRODUCTION

Mine production of most nonfuel minerals was substantially lower because of closing more major nonferrous mines in early 1987 resulting from appreciation of the yen. Mine output of bentonite, copper, dolomite, fire clay, gold, iron ore, lead, silver, tin, tungsten, and zinc all declined resulting from the mine closures or further production cutbacks. Japan stopped production of tin ore in March when the mine at Akenobe in Hyogo Prefecture was shut down permanently.

Japan's coal output declined to another historical low level in 1987 because of further mine closures and production cutbacks by major coal mining companies. Following implementation of the Eighth National Coal Policy in April, 2 of 11 remaining major coal mines were shut down permanently in Hokkaido. The coal industry was expected to reduce its coal production to 10 million tons in 1991.

In the mineral processing sector, production of primary aluminum, bismuth, cadmium, cobalt, lead, titanium sponge, and zinc declined because of high production costs, shortages of raw materials, or reduced exports due to the higher yen value. However, metal production of copper, gold, indium, rare-earth metals, selenium, silver, and steel increased due mainly to strong domestic demand. Production of cement, fertilizer materials, and refined petroleum products declined because of reduced capacity and increased imports due to the higher yen.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS					
Aluminum:					
Alumina, gross weight ____ thousand tons	1,065	1,172	978	607	358
Metal:					
Primary:					
Regular grades ____ do	256	287	227	140	41
High-purity ____ do	3	4	5	8	12
Secondary ____ do	802	819	861	876	894
Antimony:					
Oxide ____	7,596	9,698	8,243	9,677	9,805
Metal ____	273	253	296	194	196
Arsenic, white (equivalent of arsenic acid)[e] ____	300	500	500	500	500
Bismuth ____	573	563	642	640	546
Cadmium ____	2,214	2,423	2,535	2,489	2,450
Chromium:					
Chromite, gross weight ____	8,396	7,420	11,920	10,642	11,815
Metal ____	2,786	3,452	[r]3,557	2,987	[e]3,200
Cobalt metal ____	1,371	905	1,277	1,338	124
Columbium and tantalum: Tantalum metal[e] ____	40	45	45	44	44
Copper:					
Mine output, Cu content ____	46,045	43,309	43,208	34,924	23,817
Metal:					
Blister and anode:					
Primary ____	944,600	821,100	802,300	827,700	871,000
Secondary ____	117,300	107,900	130,300	124,400	97,700
Total ____	1,061,900	929,000	932,600	962,100	968,700
Refined:					
Primary ____	944,551	821,064	802,341	827,657	870,994
Secondary ____	147,378	114,092	133,636	115,380	109,355
Total ____	1,091,929	935,156	935,977	943,037	980,349
Gallium metal:					
Primary ____	3	10	10	10	10
Secondary ____	5	7	10	9	10
Germanium:					
Oxide ____	11	11	14	14	14
Metal ____	7	8	10	9	5
Gold:					
Mine output, Au content thousand troy ounces	101	104	171	331	276
Metal ____ do	1,296	1,342	1,383	1,575	1,802
Indium metal ____ do	[r]450	482	514	579	875
Iron and steel:					
Iron ore and iron sand concentrate:					
Gross weight ____ thousand tons	298	324	338	292	266
Fe content ____ do	185	202	212	182	166
Roasted pyrite concentrate (50% or more Fe) do	329	225	218	205	210
Metal:					
Pig iron and blast furnace ferroalloys do	72,936	80,403	80,569	74,651	73,352

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS —Continued					
Iron and steel —Continued					
Metal —Continued					
Electric-furnace ferroalloys:					
Ferrochrome	304,053	323,930	349,496	286,925	272,298
Ferromanganese	389,381	485,008	441,703	359,044	332,286
Ferronickel	180,826	217,053	227,043	200,311	203,143
Ferrosilicon	157,939	153,386	150,167	107,236	73,706
Silicomanganese	222,204	233,061	216,916	148,429	91,896
Ferrochromium-silicon[2]	7,152	6,451	9,463	6,377	8,310
Other:					
Calcium silicon	2,357	1,724	2,496	2,005	1,419
Ferrocolumbium	530	1,031	1,072	862	714
Ferromolybdenum	3,104	3,299	3,143	1,894	2,032
Ferrotungsten	200	144	114	122	96
Ferrovanadium	2,821	3,733	3,353	2,867	2,639
Unspecified	2,159	2,727	2,575	2,015	1,384
Total[3]	1,272,726	1,431,547	1,407,541	1,118,087	989,923
Steel, crude thousand tons	97,179	105,586	105,279	98,275	98,513
Semimanufactures, hot-rolled:					
Of ordinary steels do	77,552	82,765	82,731	78,136	78,231
Of special steels do	13,286	16,070	16,802	15,004	15,089
Lead:					
Mine output, Pb content	46,888	48,735	49,951	40,327	27,870
Metal, refined:					
Primary	203,325	233,816	233,706	232,732	218,770
Secondary	118,317	129,179	133,257	128,860	119,700
Magnesium metal:					
Primary	6,026	7,103	8,458	8,116	8,180
Secondary	13,012	15,656	20,894	13,400	10,300
Manganese:					
Ore and concentrate:					
Gross weight	75,199	61,635	21,140	5,905	--
Mn content	19,860	16,679	5,562	1,535	--
Oxide	47,182	47,807	49,081	57,159	66,731
Metal	3,939	4,323	[r]4,646	3,854	[e]3,700
Molybdenum:					
Mo content of concentrate[e]	97	147	98	--	--
Metal	438	493	565	586	624
Nickel metal:					
Refined	23,812	23,356	23,257	24,681	22,896
Ni content of nickel oxide sinter	12,600	15,150	[r]15,200	18,900	22,425
Ni content of ferronickel	45,739	50,842	54,235	49,169	49,405
Total	82,151	89,348	[r]92,692	92,750	94,726
Platinum-group metals:					
Palladium metal troy ounces	37,122	33,802	43,703	46,699	45,568
Platinum metal do	21,460	19,523	22,216	21,312	24,202
Rare-earth oxide[4]	--	--	--	--	3,053
Selenium, elemental	433	465	497	427	481
Silicon, high purity 652	908	1,471	2,094	1,671	
Silver:					
Mine output, Ag content thousand troy ounces	9,877	10,403	10,915	11,294	9,035
Metal, primary do	48,794	50,952	52,817	55,448	59,328
Tellurium, elemental	55	65	66	56	53
Tin:					
Mine output, Sn content	600	485	510	500	86
Metal, smelter	1,260	1,354	1,391	1,280	895
Titanium:					
Metal	10,590	15,368	21,897	14,481	10,083
Oxide	195,889	204,685	217,695	222,941	238,323
Tungsten:					
Mine output, W content	475	477	568	579	259
Metal	1,842	2,386	2,638	2,557	2,713
Uranium metal kilograms	4,000	4,000	5,000	5,000	5,000
Vanadium metal:[5] Secondary	706	700	762	843	[e]840
Zinc:					
Mine output, Zn content	255,712	252,700	253,021	222,071	165,675
Oxide	64,796	72,794	72,832	68,277	73,434
Metal:					
Primary	579,021	644,360	629,504	626,489	591,516
Secondary	171,016	162,317	160,652	127,291	115,847

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS —Continued					
Zirconium:					
Metal[e]	45	45	45	45	45
Oxide	4,900	6,250	[e]6,700	[e]6,700	[e]6,700
INDUSTRIAL MINERALS					
Asbestos	1,490	3,100	2,971	3,593	3,143
Barite	69,699	66,018	76,997	52,848	31,625
Bromine, elemental[e]	12,000	12,000	12,000	15,000	15,000
Cement, hydraulic thousand tons	80,892	78,859	72,845	71,261	[e]70,000
Clays:					
Bentonite	440,923	410,079	461,530	408,864	415,806
Fire clay	1,260,678	1,423,235	1,148,196	1,004,150	907,342
Kaolin	230,720	224,614	221,996	203,653	158,973
Feldspar and related materials:					
Feldspar	30,996	35,526	30,895	32,063	33,754
Aplite	401,266	441,005	469,386	457,375	466,479
Gypsum thousand tons	5,845	[e]6,050	[e]6,300	[e]6,400	[e]6,000
Iodine, elemental	7,273	7,302	7,251	7,389	7,014
Lime: Quicklime thousand tons	7,436	7,753	7,454	6,717	6,745
Nitrogen: N content of ammonia do.	1,545	1,668	1,628	1,508	1,556
Perlite[e]	75,000	75,000	75,000	75,000	75,000
Salt, all types thousand tons	921	955	1,200	1,370	1,397
Sodium compounds, n.e.s.:					
Carbonate	1,103,378	1,036,133	1,057,102	1,020,869	1,098,465
Sulfate	260,661	278,941	276,814	253,450	255,313
Stone, crushed and broken:					
Dolomite thousand tons	4,386	4,268	4,329	3,953	3,834
Limestone do.	169,780	169,825	164,156	162,358	165,957
Sulfur:					
S content of pyrite do.	272	259	253	158	79
Byproduct:					
Of metallurgy do.	1,239	1,191	1,201	1,228	[e]1,220
Of petroleum do.	1,102	1,142	1,044	985	[e]930
Talc and related materials:					
Talc	87,124	84,522	78,616	63,851	53,927
Pyrophyllite	1,378,699	1,414,424	1,355,625	1,270,112	1,241,069
Vermiculite[e]	17,000	17,000	17,000	17,000	17,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black thousand tons	568	602	632	616	629
Coal:					
Anthracite do.	17	23	26	13	10
Bituminous[6] do.	17,045	16,622	16,357	15,999	13,039
Total do.	17,062	16,645	16,383	16,012	13,049
Coke including breeze:					
Metallurgical do.	43,600	48,145	48,622	45,132	43,717
Gashouse including breeze do.	3,073	3,130	3,120	3,006	2,716
Fuel briquets, all grades do.	282	306	315	241	200
Gas, natural:					
Gross[7] million cubic feet	73,645	75,293	78,562	74,351	76,553
Marketed do.	68,957	75,329	80,122	77,989	83,000
Natural gas liquids:					
Natural gasoline thousand 42-gallon barrels	55	53	57	56	57
Liquefied petroleum gas from natural gas (field plants only)[e] do.	300	300	300	300	300
Peat[e]	60	60	60	60	60
Petroleum:					
Crude thousand 42-gallon barrels	3,095	2,962	3,929	4,629	4,453
Refinery products:					
Gasoline:					
Aviation do.	82	88	75	82	57
Other do.	223,590	227,678	215,514	214,866	216,136
Jet fuel do.	27,933	23,499	27,229	25,285	25,348
Kerosene do.	168,982	168,774	152,477	151,484	126,003
Distillate fuel oil do.	144,936	155,817	147,596	164,308	158,685
Residual fuel oil do.	485,258	479,836	408,655	386,452	378,659
Lubricants do.	11,517	12,032	12,133	11,730	12,271
Asphalt and bitumen do.	29,682	30,719	29,814	33,418	34,436
Liquefied petroleum gas do.	48,733	47,029	50,243	44,010	45,029
Naphtha do.	72,509	73,175	65,093	60,822	55,250

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Paraffin ---------- do	981	1,050	994	[e]980	[e]900
Petroleum coke ---------- do	717	881	1,088	956	824
Unfinished oils ---------- do	4,478	48,243	39,525	40,928	43,161
Refinery fuel and losses ---------- do	88,591	[8]130,666	[8]153,968	[8]136,458	[8]140,464
Total ---------- do	1,307,989	1,399,487	1,304,404	[e]1,271,779	[e]1,237,223

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

[1]Table includes data available through Sept. 6, 1988.

[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, in metric tons: 1983—1,258,422; 1984—1,418,645; 1985—1,388,615; 1986—1,105,333; and 1987—973,303. 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 oxide of cerium, europium, gadolinium, lanthanum, neodymium, praseodymium, samarium, terbium, yttrium, and neodymium fluoride.

[5]Represents metal content of vanadium pentoxide recovered from petroleum residues, ashes, and spent catalysts.

[6]Includes coking coal and steam coal.

[7]Includes output from gas wells and coal mines.

[8]May include some additional unfinished oils.

TRADE

Despite a decrease in volume of exports and a substantial increase in imports, Japan's merchandise trade surplus remained high at $80 billion compared with $83 billion in 1986 principally because of an additional 14% appreciation of the yen on the U.S. dollar-based export commodities in 1987. Export earnings rose 9.6% to $229 billion while imports surged 18% to $149 billion. The Japanese bilateral trade surplus with the United States remained at $52.2 billion in 1987. Exports to the United States rose 13.6% to $83.6 billion, while imports from the United States increased only 4.9% to $ 31.4 billion.[5]

Major export commodities such as motor vehicles, office equipment, tape recorders, chemicals, scientific and optical equipment, thermionic products, metal-working and power-generating machinery, and radio and TV receivers, with the exception of iron and steel products, continued to grow and contributed most to the increased export earnings in 1987. Foodstuff and raw materials such as mineral fuels, iron ore, nonferrous metal ore, and iron and steel scrap, chemicals, and nonferrous metals remained major import commodities. However, there were substantial increases in imports of chemicals, nonferrous metal ore and products and refined petroleum products, reflecting further openings in the Japanese market for foreign goods.

In 1987, imports of mineral fuels included $20 billion of crude and partially refined petroleum, $7 billion of refined petroleum products, and $5 billion of coal. Imports of nonfuel minerals and metals included $6 billion of nonferrous metals, $2 billion of iron ore, $2 billion of nonferrous metal ore, and $250 million of iron and steel scrap. Exports of minerals and metals included $13 billion of iron and steel products, $5 billion of nonferrous metals, and $3 billion of industrial mineral products.

The United States remained the most important trade partner of Japan, accounting for 36% of Japan's exports and 21% of Japan's imports. In mineral trade, the United States remained a major supplier of aluminum, beryllium, coal, copper, gold, kaolin, magnesium, molybdenum, petroleum coke, phosphate rock, refined petroleum products, rare earths, silver, and precious and semiprecious stones. Japan remained a major supplier of aluminum and copper semimanufactures, iodine, iron and steel products, iron oxide, manganese oxide, titanium sponge, and titanium mill products in 1987. Other major mineral trade partners of Japan included Australia, Brazil, Canada, Chile, India, Indonesia, the Republic of Korea, Malaysia, Mexico, New Caledonia, Papua New Guinea, Peru, the Philippines, Saudi Arabia, the Republic of Korea, the Republic of South Africa, and the United Arab Emirates. Among these raw material suppliers, Japan displaced the United States and became the leading trade partner of the Republic of South Africa in 1987 because of the U.S. sanction against the Republic of South Africa.

Table 2.—Japan: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals	292	231	1	Republic of Korea 87; Taiwan 73; India 62.
Aluminum:				
Ore and concentrate	340	429	--	All to Republic of Korea.
Oxides and hydroxides	481,536	384,473	4,245	Canada 242,704; Republic of Korea 46,075; Indonesia 25,158.
Metal including alloys:				
Scrap	2,317	1,914	35	Taiwan 1,205; Republic of Korea 598.
Unwrought	2,239	2,021	279	Republic of Korea 590; Thailand 314; Burma 262.
Semimanufactures	246,130	225,463	142,830	Republic of Korea 13,120; Taiwan 12,480; China 11,595.
Antimony: Metal including alloys, all forms	6	2	--	Mainly to Canada.
Beryllium: Metal including alloys, all forms kilograms	109	811	--	Republic of Korea 639; India 150; Taiwan 22.
Bismuth: Metal including alloys, all forms	230	257	66	Netherlands 112; China 37.
Cadmium: Metal including alloys, all forms	382	452	(2)	East Germany 184; Netherlands 144; United Kingdom 55.
Chromium:				
Ore and concentrate	756	283	--	Republic of Korea 199; Indonesia 41.
Oxides and hydroxides	3,247	3,990	635	Taiwan 1,320; Republic of Korea 1,061.
Cobalt: Oxides and hydroxides	12	24	1	Taiwan 9; Republic of Korea 6; Vietnam 3.
Columbium and tantalum: Metal including alloys, all forms, tantalum	12	11	1	China 4; Austria 2; West Germany 2.
Copper:				
Ore and concentrate	--	1,684	--	North Korea 1,149; Sweden 535.
Sulfate	508	603	2	Taiwan 488; Republic of Korea 73; United Kingdom 17.
Metal including alloys:				
Scrap	51,591	65,944	20	Taiwan 23,572; China 16,473; Republic of Korea 14,322.
Unwrought	7,559	24,295	17	Republic of Korea 15,757; Philippines 3,263; Belgium-Luxembourg 3,000.
Semimanufactures	193,882	209,191	44,463	Taiwan 37,600; China 19,184; Republic of Korea 11,295.
Gold:				
Waste and sweepings value, thousands	--	$4	--	All to Taiwan.
Metal including alloys, unwrought and partly wrought troy ounces	143,497	187,324	6,144	Singapore 93,961; Republic of Korea 33,833; Taiwan 19,481.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	17	108	50	Taiwan 40; China 12.
Pyrite, roasted	--	5	--	All to Republic of Korea.
Metal:				
Scrap	165,636	461,048	17	China 244,582; Taiwan 94,412; Republic of Korea 89,463.
Pig iron, cast iron, related materials thousand tons	1,085	1,074	6	China 713; Republic of Korea 192.
Ferroalloys:				
Ferrochromium	5,468	3,433	884	India 996; North Korea 567; Australia 517.
Ferromanganese	25,988	6,857	34	Cuba 1,313; Republic of Korea 956; Australia 889.
Ferronickel	4,475	7,100	--	All to Netherlands.
Ferrosilicomanganese	170	16	--	Taiwan 14.
Ferrosilicon	913	1,091	--	Taiwan 485; Republic of Korea 342.
Unspecified	2,077	3,246	275	Republic of Korea 1,875; Taiwan 629.
Steel, primary forms thousand tons	3,168	2,979	266	Republic of Korea 958; China 617.

See footnotes at end of table.

Table 2.—Japan: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections thousand tons	7,844	6,417	779	China 2,945; Taiwan 395; Republic of Korea 335.
Universals, plates, sheets do	12,554	11,870	1,909	China 3,401; Taiwan 759; Republic of Korea 683.
Hoop and strip do	598	620	90	China 174; Taiwan 62; Hong Kong 46.
Rails and accessories do	361	246	65	China 83; Canada 46.
Wire do	317	302	95	China 60; Taiwan 16.
Tubes, pipes, fittings do	6,871	5,692	463	U.S.S.R. 2,065; China 1,088; Iraq 202.
Castings and forgings, rough do	23	20	11	Singapore 3; Taiwan 2.
Lead:				
Ore and concentrate	5,343	--	--	
Oxides	74	55	(2)	Vietnam 20; Taiwan 11; Republic of Korea 8.
Metal including alloys, all forms	29,711	28,761	58	Singapore 7,648; Republic of Korea 6,722; North Korea 6,491.
Magnesium: Metal including alloys, all forms	2,661	1,007	(2)	China 783; Taiwan 131; Singapore 33.
Manganese:				
Ore and concentrate	1,605	1,293	--	Philippines 736; Republic of Korea 298; Bangladesh 100.
Oxides	44,267	35,527	8,091	U.S.S.R. 5,200; Indonesia 5,148; West Germany 2,672.
Mercury 76-pound flasks	9,600	7,904	2,502	Netherlands 4,504; Thailand 312; Philippines 195.
Molybdenum: Metal including alloys, all forms	56	63	11	West Germany 14; Republic of Korea 12; Hungary 9.
Nickel: Metal including alloys, all forms	4,211	4,828	397	Taiwan 2,515; United Arab Emirates 1,007.
Platinum-group metals:				
Waste and sweepings value, thousands	$22	$1	--	Mainly to United Kingdom.
Metals including alloys, unwrought and partly wrought troy ounces	127,499	73,654	40,532	Taiwan 9,599; West Germany 8,417; Republic of Korea 5,244.
Selenium, elemental	273	171	30	United Kingdom 31; Netherlands 26; Taiwan 19.
Silver:				
Waste and sweepings value, thousands	$52	$82	$5	West Germany $47; Switzerland $17.
Metal including alloys, unwrought and partly wrought thousand troy ounces	3,003	2,031	17	Taiwan 796; Singapore 394; Republic of Korea 285.
Tin:				
Oxides	11	15	1	Taiwan 8; North Korea 2; Republic of Korea 1.
Metal including alloys, all forms	695	467	4	Republic of Korea 107; Taiwan 79; Hong Kong 73.
Titanium:				
Oxides	19,007	22,209	172	Taiwan 7,612; China 4,830; Republic of Korea 2,285.
Metal including alloys, all forms	7,330	6,143	2,118	France 683; United Kingdom 631; Sweden 494.
Tungsten: Metal including alloys, all forms	235	261	84	West Germany 59; Taiwan 40; Republic of Korea 25.
Uranium and/or thorium: Oxides and other compounds	428	406	18	Republic of Korea 173; Taiwan 74; United Kingdom 48.

See footnotes at end of table.

Table 2.—Japan: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Zinc:				
Oxides	809	762	125	Taiwan 204; Thailand 107; Republic of Korea 97.
Metal including alloys, all forms	38,522	28,839	47	Taiwan 12,688; Republic of Korea 5,716; Philippines 5,244.
Other:				
Ores and concentrates	310	8,862	(2)	Sweden 5,250; Republic of Korea 3,585.
Ashes and residues	9,388	4,141	--	Taiwan 2,450; United Kingdom 530; Namibia 300.
Base metals including alloys, all forms	3,121	3,214	1,247	West Germany 511; U.S.S.R. 322; Republic of Korea 270.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	11,845	11,624	1	Republic of Korea 4,858; Hong Kong 4,848; Taiwan 751.
Artificial:				
Corundum	19,235	20,904	510	Republic of Korea 10,602; Taiwan 3,079; Romania 1,200.
Silicon carbide	3,027	4,171	51	Republic of Korea 2,312; Taiwan 1,396; Australia 308.
Dust and powder of precious and semiprecious stones including diamond kilograms	2,226	4,352	758	Taiwan 1,669; West Germany 1,108; China 598.
Grinding and polishing wheels and stones	9,482	7,147	1,347	Hong Kong 828; Republic of Korea 774; U.S.S.R. 760.
Asbestos, crude	292	163	--	Republic of Korea 108; Taiwan 23.
Barite and witherite	13	--		
Boron materials:				
Crude natural borates	2,190	1,405	--	Taiwan 1,240; Republic of Korea 160.
Oxides and acids	188	159	1	Republic of Korea 122; Taiwan 25.
Cement thousand tons	9,130	5,617	838	Hong Kong 1,788; Saudi Arabia 1,243; Singapore 701.
Clays, crude	63,554	64,931	2	Taiwan 36,931; Republic of Korea 13,129; Iral 4,216.
Cryolite and chiolite	24	10	--	All to Republic of Korea.
Diamond:				
Gem, not set or strung carats	1,192	15,513	4,659	Republic of Korea 7,400; Singapore 1,545; Hong Kong 1,108.
Industrial stones do	4,694	89,188	--	Republic of Korea 71,128; Italy 9,000; Australia 5,000.
Diatomite and other infusorial earth	2,599	1,506	4	Thailand 470; Taiwan 296; Australia 281.
Feldspar	27,646	32,822	--	Taiwan 30,323; Indonesia 1,015; Republic of Korea 702.
Fertilizer materials:				
Crude, n.e.s	344	557	--	North Korea 298; Taiwan 253.
Manufactured:				
Ammonia	2,137	393	--	Thailand 212; Malaysia 67; Republic of Korea 44.
Nitrogenous	739,909	717,616	7,456	Thailand 265,179; Philippines 125,828; Malaysia 109,119.
Phosphatic	3,659	30,050	--	Burma 27,661; Sudan 700; Yemen (Sanaa) 698.
Potassic	82	310	--	Philippines 184; Somalia 110.
Unspecified and mixed	150,918	123,621	1,435	Thailand 50,000; Sri Lanka 13,620; Philippines 10,300.
Fluorspar	157	157	--	Taiwan 94; Philippines 35.
Graphite, natural	2,553	2,666	229	Republic of Korea 1,051; Taiwan 499; Czechoslovakia 248.
Gypsum and plaster	6,142	4,837	5	Taiwan 1,513; Indonesia 1,154; Malaysia 789.
Iodine including bromine and fluorine	6,605	6,641	1,902	United Kingdom 1,129; West Germany 864; France 636.
Kyanite and related materials	11,946	12,473	371	Republic of Korea 5,751; Taiwan 3,428; Indonesia 2,032.
Lime	34,219	7,842	(2)	Papua New Guinea 5,034; Indonesia 2,000; Hong Kong 367.

See footnotes at end of table.

Table 2.—Japan: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Magnesium compounds: Oxides and hydroxides	108,776	126,613	29,751	Republic of Korea 34,944; Australia 13,285; Netherlands 10,072.
Mica, all forms	1,159	1,310	50	Hong Kong 368; Taiwan 322; Republic of Korea 243.
Nitrates, crude	15	--		
Phosphorus, elemental	301	167	5	Indonesia 51; Taiwan 26; United Kingdom 23.
Pigments, mineral:				
Natural, crude	33	51	1	Republic of Korea 32; Taiwan 16.
Iron oxides and hydroxides, processed	15,025	18,587	1,401	Taiwan 6,485; Republic of Korea 5,540; U.S.S.R. 910.
Precious and semiprecious stones other than diamond:				
Natual kilograms	25,159	28,121	82	India 11,846; Republic of Korea 10,656; Hong Kong 3,173.
Synthetic do	67,580	114,461	22,768	Malaysia 20,661; Republic of Korea 16,387; Taiwan 16,380.
Pyrite, unroasted	248	402	--	Australia 400.
Salt and brine	1,414	1,182	312	North Korea 296; Caroline, Marianas, and Marshall Islands 138; Malaysia 101.
Sodium compounds, n.e.s.:				
Carbonate manufactured	64,865	81,968	8	China 37,245; Philippines 18,900; Indonesia 15,462.
Sulfate, manufactured	6,138	5,593	--	Republic of Korea 3,381; Thailand 1,235; Indonesia 801.
Stone, sand and gravel:				
Dimension stone:				
Crude and prtly worked	405	828	--	Republic of Korea 790.
Worked	8,581	1,506	121	Singapore 932; Republic of Korea 226.
Dolomite, chiefly refractory-grade	5,704	1,883	--	Indonesia 1,356; Taiwan 280; Republic of Korea 240.
Gravel and crushed rock	186,445	87,916	62	Australia 87,000; Republic of Korea 346; Iraq 147.
Limestone other than dimension	1,041,283	1,153,077	570	India 99,060; Singapore 27,134; Republic of Korea 22,127.
Quartz and quartzite	267	518	20	Malaysia 196; Taiwan 118; Republic of Korea 79.
Sand other than metal-bearing	4,083	3,687	12	Taiwan 1,226; Republic of Korea 1,189; Singapore 703.
Sulfur:				
Elemental:				
Crude including native and by-product	165,981	77,815	420	Republic of Korea 67,749; Taiwan 8,700.
Colloidal, precipitated, sublimed	382	1,201	33	Canada 453; Taiwan 337; Republic of Korea 309.
Sulfuric acid	322,568	500,421	18,503	Republic of Korea 147,701; Taiwan 132,561; Philippines 117,089.
Talc, steatite, soapstone, pyrophyllite	4,792	3,518	50	Republic of Korea 1,742; Taiwan 870; Philippines 297.
Other:				
Crude	24,584	29,590	507	Republic of Korea 21,163; Taiwan 3,607; Indonesia 840.
Slag and dross, not metal-bearing	325,276	392,975	36,006	Singapore 175,300; Republic of Korea 52,863.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	7	12	1	Republic of Korea 6; Western Samoa 3; Sri Lanka 2.
Carbon black	9,940	8,405	567	Republic of Korea 2,119; Taiwan 1,850; Indonesia 1,310.
Coal, all grades including briquets	4,242	1,167	--	Republic of Korea 560; Cuba 200; Taiwan 171.
Carbon black	9,940	8,405	567	Republic of Korea 2,119; Taiwan 1,850; Indonesia 1,310.
Coal, all grades including briquets	4,242	1,167	--	Republic of Korea 560; Cuba 200; Taiwan 171.
Coke and semicoke thousand tons	2,264	2,348	232	Romania 753; Philippines 261; Taiwan 169.
Peat including briquets and litter	253	272	--	All to China.

See footnotes at end of table.

Table 2.—Japan: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	410	184	174	U.S.S.R. 5; Hong Kong 4.
Gasoline do	319	122	(2)	Taiwan 78; Indonesia 25; Philippines 10.
Mineral jelly and wax do	493	516	75	Republic of South Africa 93; Republic of Korea 85; India 77.
Kerosene and jet fuel do	414	1,356	--	Iran 1,059; Republic of Korea 292.
Distillate fuel oil do	419	2,270	3	Iran 1,652; Republic of Korea 613.
Lubricants do	1,195	1,531	50	Republic of Korea 527; Taiwan 208; Singapore 200.
Nonlubricating oils do	255	246	2	Republic of Korea 90; Taiwan 73.
Residual fuel oil do	1,444	1,797	--	Republic of Korea 1,796.
Bitumen and other residues do	40	17	(2)	Singapore 5; Thailand 4; Indonesia 2.
Bituminous mixtures do	7	8	(2)	Indonesia 4.
Petroleum coke do	390	582	114	Romania 148; U.S.S.R. 142; Netherlands 103.

[1]Exludes exports under Japanese-United States Mutual Defense Agreement or for account of U.S. military forces. Table prepared by Audrey Wilkes.
[2]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkaline-earth metals	71	124	33	China 82; West Germany 6.
Unspecified	859	1,062	347	China 393; France 262.
Aluminum:				
Ore and concentrate thousand tons	3,519	2,307	(2)	Australia 1,354; Indonesia 597; Malaysia 238.
Oxides and hydroxides	44,005	66,053	21,085	Australia 41,260; West Germany 2,938.
Metal including alloys:				
Scrap	361,053	358,813	241,747	Australia 26,776; Hong Kong 20,155; Canada 10,535.
Unwrought	1,576	1,366	157	Australia 306; Venezuela 171; New Zealand 169.
Semimanufactures	34,825	35,595	5,454	Romania 6,140; Argentina 3,361; France 3,068.
Antimony:				
Ore and concentrate	5,091	6,400	--	Bolivia 4,829; China 979; Guatemala 400.
Oxides	2,672	3,609	91	China 1,950; United Kingdom 1,117.
Metal including alloys, all forms	4,269	3,985	--	China 3,982.
Arsenic: Oxides and acids	144	161	--	France 140; Republic of Korea 17.
Beryllium:				
Oxides and hydroxides	100	100	80	China 20.
Metal including alloys,, all forms kilograms	744	1,253	1,241	China 10.
Chromium:				
Ore and concentrate	987,240	670,625	--	Republic of South Africa 379,867; Madagasgar 102,567; India 49,710.
Oxides and hydroxides	2,278	2,300	1,132	West Germany 918; U.S.S.R. 100.
Cobalt:				
Oxides and hydroxides	259	460	48	Belgium-Luxembourg 346.
Metal including alloys, all forms	2,312	3,453	201	Zaire 2,016; Belgium-Luxembourg 396; Zambia 359.
Columbium and tantalum:				
Ore and concentrate	2,195	1,717	--	Canada 1,502; Brazil 169.
Metal including alloys, all forms, tantalum	79	46	36	West Germany 8.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Copper:				
Ore and concentrate thousand tons	3,010	3,037	457	Canada 910; Chile 322; Philippines 307.
Matte and speiss including cement copper	132	33	--	All from Taiwan.
Sulfate	400	650	(2)	China 278; U.S.S.R. 180; Thailand 68.
Metal including alloys:				
Scrap	81,663	79,467	38,202	Hong Kong 11,689; Saudi Arabia 7,423; Singapore 6,979.
Unwrought	r393,151	303,034	305	Zambia 138,607; Chile 48,332; Peru 42,449.
Semimanufactures	r14,189	21,134	1,483	Taiwan 11,583; Republic of Korea 4,432; Italy 1,395.
Germanium: Metal including alloys, all forms kilograms	3,975	2,878	210	China 2,002; France 400.
Gold:				
Ore and concentrate value, thousands	$36	--	--	
Waste and sweepings kilograms	1,011	1,666	--	Singapore 1,353; Hong Kong 313.
Metal including alloys, unwrought and partly wrought thousand troy ounces	6,328	19,542	7,552	United Kingdom 4,243; Switzerland 3,753.
Indium: Metal including alloys, all forms kilograms	8,249	21,524	8,204	China 7,960; Belgium-Luxembourg 2,696.
Iron and steel:				
Iron ore and concentrate, excluding roasted pyrite thousand tons	124,513	115,234	--	Australia 46,894; Brazil 26,633; India 20,750.
Metal:				
Scrap do	3,254	3,224	1,635	U.S.S.R. 826; Australia 216.
Pig iron, cast iron, related materials do	748	968	1	Republic of South Africa 541; Brazil 114; U.S.S.R. 105.
Ferroalloys:				
Ferrochromium	317,595	372,513	--	Republic of South Africa 235,213; Philippines 43,181; Zimbabwe 34,679.
Ferromanganese	5,878	7,125	--	Brazil 3,488; India 986; Norway 703.
Ferromolybdenum	988	1,065	--	Austria 360; Chile 323; China 142.
Ferronickel	20,247	38,700	157	New Caledonia 13,690; Indonesia 13,073; Dominica 5,976.
Ferrosilicochromium	10,026	10,356	--	Zimbabwe 5,200; Republic of South Africa 5,056.
Ferrosilicomanganese	121,600	176,821	--	Republic of South Africa 72,819; Brazil 51,167; U.S.S.R. 24,489.
Ferrosilicon	306,830	350,069	--	Norway 83,087; Brazil 79,386; Republic of South Africa 28,039.
Silicon metal	102,797	103,860	1,941	China 33,277; Norway 15,890; Brazil 13,480.
Unspecified	10,839	11,936	94	Brazil 4,741; China 1,873; France 1,688.
Steel, primary forms	3,644,374	1,743,567	18,077	Republic of Korea 702,430; Brazil 447,198; Republic of South Africa 81,358.
Semimanufactures:				
Universals, plates, sheets[4] do	1,075,305	1,230,439	7,844	Republic of Korea 506,654; Brazil 179,345; Romania 153,484.
Unspecified[5]	82,925	316,033	1,903	Republic of Korea 220,664; Singapore 17,802.
Lead:				
Ore and concentrate	261,795	273,829	18,224	Canada 67,319; Australia 60,665; Peru 45,007.
Oxides	8,518	12,070	9	Mexico 10,714; China 885; France 298.
Metal including alloys:				
Scrap	185	83	17	Papua New Guinea 49; Singapore 17.
Unwrought	87,840	70,346	760	Australia 25,331; Taiwan 9,651; Mexico 8,410.
Semimanufactures	41	43	42	France[2].
Lithium:				
Oxides and hydroxides	797	885	725	China 81; U.S.S.R. 60.
Metal including alloys, all forms	42	50	35	United Kingdom 8; West Germany 7.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Magnesium: Metal including alloys:				
Scrap	293	472	(2)	Taiwan 191; Sweden 125; West Germany 51.
Unwrought	15,621	12,643	8,620	Norway 2,231; Canada 1,184.
Semimanufactures	318	398	336	Canada 43; Republic of Korea 13.
Manganese:				
Ore and concentrate, metallurgical-grade, thousand tons	2,183	1,807	--	Republic of South Africa 1,018; Australia 399; India 226.
Oxides	1,782	1,421	35	Belgium-Luxembourg 1,340; China 34.
Mercury, 76-pound flasks	513	860	(2)	China 720; Algeria 100.
Molybdenum:				
Ore and concentrate	21,138	18,024	4,522	Chile 7,272; Canada 3,485; Netherlands 1,934.
Oxides and hydroxides	384	414	269	Taiwan 55; China 41.
Metal including alloys, all forms	427	290	118	West Germany 106; Austria 29; China 28.
Nickel:				
Ore and concentrate, thousand tons	2,976	2,886	NA	Indonesia 1,367; New Caledonia 988; Philippines 511.
Matte and speiss	52,462	58,187	--	Indonesia 35,858; Australia 21,753.
Metal including alloys:				
Scrap	2,622	2,219	1,366	Taiwan 533; United Kingdom 56.
Unwrought	25,092	24,475	545	Canada 4,072; U.S.S.R. 3,744; Zimbabwe 3,262.
Semimanufactures	5,577	5,256	617	United Kingdom 1,991; Philippines 1,260.
Platinum-group metals:				
Ore and concentrate	$1	--		
Waste and sweepings, kilograms	2,664	3,179	1,478	Taiwan 1,383; Australia 240.
Metals including alloys, unwrought and partly wrought				
Palladium, thousand troy ounces	1,107	1,369	96	U.S.S.R. 851; Republic of South Africa 244; Taiwan 106.
Platinum, do.	1,304	996	64	Republic of South Africa 571; U.S.S.R. 148.
Rhodium, do.	61	93	8	U.S.S.R. 48; Republic of South Africa 26.
Iridium, osmium, ruthenium, do.	86	73	(2)	Republic of South Africa 55; United Kingdom 11.
Rare-earth metals including alloys, all forms	60	132	10	China 83; Brazil 33.
Selenium, elemental	12	8	(2)	Philippines 7.
Silicon, high-purity	144	66	23	France 16; Italy 11; Denmark 10.
Silver:				
Ore and concentrate	68	1,907	11	Australia 1,814; Spain 82.
Waste and sweepings, kilograms	701	819	--	All from Malaysia.
Metal including alloys, unwrought and partly wrought, thousand troy ounces	18,351	15,488	1,916	Mexico 8,283; Peru 3,608.
Tellurium, elemental	4	1	(2)	Mainly from Belgium-Luxembourg.
Tin:				
Ore and concentrate	48	2	--	All from China.
Oxides	8	9	--	United Kingdom 8.
Metal including alloys:				
Scrap	15	4	--	Mainly from Philippines.
Unwrought	30,282	32,311	NA	Malaysia 14,794; Thailand 8,871; Indonesia 4,955.
Semimanufactures	53	278	5	Thailand 237; Malaysia 16; Taiwan 12.
Titanium:				
Ore and concentrate	604,044	670,436	--	Malaysia 261,524; Australia 198,309; Canada 116,547.
Oxides	6,285	4,864	123	Republic of Korea 1,412; Belgium-Luxembourg 1,371; China 784.
Tungsten:				
Ore and concentrate	2,869	1,769	18	Portugal 680; Republic of Korea 334; Bolivia 231.
Metal including alloys, all forms	350	255	27	Republic of Korea 116; West Germany 84.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Uranium and/or thorium:				
Oxides and other compounds kilograms	807	1,068	140	India 600; West Germany 328.
Metal including alloys, all forms, uranium do	36	(6)	(6)	
Vanadium:				
Ore and concentrate	--	68	--	All from Republic of South Africa.
Oxides and hydroxides	3,786	3,101	107	Republic of South Africa 2,551; China 299.
Zinc:				
Ore and concentrate	856,648	916,166	3,775	Australia 496,981; Peru 225,549; Canada 129,865.
Oxides	6,746	7,368	50	Republic of Korea 3,389; Taiwan 2,279; China 993.
Metal including alloys:				
Scrap	345	57	7	Singapore 34; Malaysia 16.
Unwrought	70,549	101,444	17	North Korea 39,054; Peru 21,716; Mexico 10,781.
Semimanufactures	385	857	89	Norway 395; West Germany 155.
Zirconium:				
Ore and concentrate	238,321	171,709	24	Australia 151,762; Republic of South Africa 18,513.
Metal including alloys, all forms	173	131	44	France 84.
Other:				
Ores and concentrates	119	10,769	10,709	Canada 45.
Oxides and hydroxides	592	576	11	Norway 346; Canada 179.
Ashes and residues	89,898	76,268	16,072	Australia 24,967; Taiwan 11,881; Philippines 7,218.
Base metals including alloys, all forms	6,470	5,284	1,342	Republic of South Africa 2,179; China 1,051.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	9,889	6,820	1,792	India 4,032; Australia 542.
Artificial:				
Corundum	22,529	28,050	154	China 17,806; Brazil 4,864.
Silicon carbide	23,994	28,475	62	China 14,672; Brazil 5,964; Norway 3,092.
Dust and powder of precious and semiprecious stones excluding diamond kilograms	421,400	593,386	77,626	India 378,000; West Germany 137,760.
Grinding and polishing wheels and stones	352	388	36	Austria 134; Italy 81; Republic of Korea 52.
Asbestos, crude	261,648	255,732	9,483	Canada 100,642; Republic of South Africa 57,119; Zimbabwe 36,920.
Barite and witherite	50,356	30,962	5	China 30,927.
Boron materials:				
Crude natural borates	59,075	57,250	--	Turkey 56,000; U.S.S.R. 1,250.
Elemental[7]	41	44	(2)	China 33; Sweden 10.
Oxides and acids	26,393	25,236	18,318	Italy 4,641; U.S.S.R. 618.
Bromine and iodine	3,156	3,078	264	Israel 2,814.
Cement	476,928	1,196,485	38	Republic of Korea 757,038; Taiwan 435,759.
Chalk	3	205	1	Denmark 204.
Clays, crude:				
Kaolin	706,745	678,359	464,755	Brazil 92,535; Republic of Korea 52,053; Malaysia 22,092.
Unspecified	281,951	284,022	138,961	China 109,424; Republic of Korea 18,930.
Cryolie and chiolite	437	357	--	Denmark 255; Greenland 102.
Diamond:				
Gem, not set or strung thousand carats	1,224	1,774	134	India 733; Israel 381; Belgium-Luxembourg 314.
Industrial stones do	722	738	160	Republic of South Africa 272; Zaire 152; Ghana 42.
Dust and powder do	33,056	37,419	10,968	Ireland 24,425; Zaire 948; West Germany 484.
Diatomite and other infusorial earth	3,164	3,901	3,880	West Germany 10.
Feldspar	7,802	6,766	--	China 3,626; Canada 1,438; North Korea 880.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Fertilizer materials:				
Crude, n.e.s	1,184	24,585	--	Italy 22,000; Philippines 1,134; Argentina 790.
Manufactured:				
Ammonia kilograms	435	926	288	West Germany 638.
Nitrogenous	73,151	203,285	10,695	Indonesia 76,709; Qatar 29,407; Malaysia 27,480.
Phosphatic	54,558	107,919	42,653	Republic of Korea 34,766; China 29,213.
Potassic	1,375,430	1,199,454	163,036	Canada 568,376; U.S.S.R. 168,567; West Germany 107,772.
Unspecified and mixed	324,610	374,144	273,020	Republic of Korea 66,903; Philippines 16,500.
Fluorspar	570,656	527,236	--	China 350,833; Thailand 75,539; Republic of South Africa 70,304.
Graphite, natural	78,857	58,645	266	China 30,944; Republic of Korea 19,512.
Gypsum and plaster	305,694	776,349	453	Thailand 419,553; Mexico 273,904.
Kyanite and related materials	28,413	28,653	7,206	Republic of South Africa 21,376.
Magnesium compounds:				
Magnesite, crude	38,538	33,613	1	China 32,369; North Korea 743.
Oxides and hydroxides	304,073	233,320	206	China 200,257; North Korea 32,264.
Meerschaum, amber, jet	31	82	--	China 81.
Mica:				
Crude including splittings and waste	10,865	15,143	276	India 7,086; Canada 2,600; China 2,075.
Worked including agglomerated splittings	105	166	2	Belgium-Luxembourg 84; India 72.
Nitrates, crude	3,000	--	--	
Phosphates, crude thousand tons	2,414	2,076	1,099	Morocco 510; Jordan 306.
Phosphorus, elemental	24,552	25,119	8,432	Canada 9,006; China 2,046; Netherlands 1,972.
Pigments, mineral:				
Natural, crude	386	847	5	China 694; Austria 119.
Iron oxides and hydroxides, processed	12,724	8,552	1,948	West Germany 5,169; Italy 408.
Precious and semiprecious stones other than diamond:				
Natural:				
Gem material kilograms	331,822	402,959	21,070	Brazil 159,131; Republic of South Africa 49,281; Turkey 40,850.
Industrial stones do	5	3	--	All from West Germany.
Synthetic do	79,735	136,049	106,181	West Germany 25,225.
Pyrite, unroasted	2,281	28,246	2	Australia 16,617; China 7,531; Philippines 4,096.
Salt and brine thousand tons	6,833	6,614	(2)	Australia 3,188; Mexico 2,729; China 697.
Sodium compounds, n.e.s.:				
Carbonate, natural and manufactured	1	4,283	--	Kenya 3,245; Republic of Korea 1,000.
Sulfate, manufactured	85,274	95,856	19,149	China 56,711; Mexico 10,599; Taiwan 8,847.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	704,910	870,355	22,797	Republic of Korea 285,820; India 196,882; China 136,991.
Worked	107,649	148,296	59	Republic of Korea 80,496; Italy 24,952.
Dolomite, chiefly refractory-grade	488,511	520,560	3,303	Philippines 273,009; Republic of Korea 118,701.
Gravel and crushed rock	217,421	189,709	408	Taiwan 168,285; Philippines 10,677.
Limestone other than dimension	648	15,721	(2)	Philippines 15,017; France 660.
Quartz and quartzite	142,496	120,638	1,691	India 73,059; Thailand 18,800; China 13,490.
Sand other than metal-bearing thousand tons	1,229	1,227	1	Australia 773; Taiwan 316; Malaysia 98.
Sulfur:				
Elemental:				
Crude including native and by-product	87	2,023	--	All from China.
Colloidal, precipitated, sublimed	4	58	(2)	China 50; West Germany 5.
Sulfuric acid	5	13	6	Taiwan 6.
Talc, steatite, soapstone, pyrophyllite	573,901	614,422	18,652	China 456,318; Australia 110,859.
Other:				
Crude	272,664	245,979	5,097	Republic of Korea 134,571; China 82,329; Spain 24,284.
Slag and dross, not metal-bearing	434,449	435,323	22,730	Republic of Korea 127,372; Taiwan 85,291; Republic of South Africa 74,857.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERALS FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	3,186	3,322	2,443	Trinidad and Tobago 879.
Carbon black	9,173	10,846	6,354	Republic of Korea 1,234; Canada 947.
Coal:				
Anthracite thousand tons	1,950	1,971	(2)	Republic of South Africa 875; North Korea 406; Australia 299.
Bituminous do	91,040	89,376	12,178	Australia 41,975; Canada 17,541; Republic of South Africa 7,960.
Lignite including briquets	31,585	25,415	653	U.S.S.R. 19,330; Australia 4,392; China 1,040.
Coke and semicoke	34,805	44,977	944	Australia 33,567; Taiwan 4,497; China 3,607.
Gas, natural: Liquefied thousand tons	27,790	28,394	964	Indonesia 14,916; Brunei 5,262; Malaysia 5,028.
Peat including briquets and litter	20,789	31,577	182	Canada 28,429; U.S.S.R. 1,759.
Petroleum:				
Crude thousand 42-gallon barrels	1,218,423	1,157,267	(2)	United Arab Emirates 262,093; Saudi Arabia 202,282; Indonesia 132,854.
Refinery products:				
Liquefied petroleum gas do	133,645	137,719	(2)	Saudi Arabia 65,785; United Arab Emirates 33,098; Australia 13,886.
Gasoline do	109,990	132,945	5,092	Saudi Arabia 28,895; Kuwait 17,266; Singapore 16,954.
Mineral jelly and wax do	76	174	38	Singapore 97; Republic of South Africa 22.
Kerosene and jet fuel do	12,817	32,859	1,307	Singapore 10,720; Saudi Arabia 5,054; United Arab Emirates 4,128.
Distillate fuel oil do	3,168	9,836	3,114	Algeria 1,686; Saudi Arabia 1,476; China 1,390.
Lubricants do	226	269	173	West Germany 35; Republic of Korea 23.
Nonlubricating oils do	154	169	114	Taiwan 31.
Residual fuel oil do	93,207	103,377	10,687	Indonesia 25,688; Singapore 18,039; Saudi Arabia 13,491.
Bitumen and other residues do	140	250	172	NA.
Bituminous mixtures do	11	13	5	Republic of Korea 6.
Petroleum coke do	19,960	21,415	19,764	China 773.

[r]Revised. NA Not available.

[1]Excludes imports under Japanese-United States Mutual Defense Agreement or for account of U.S. military forces. Table prepared by Audrey D. Wilkes.

[2]Less than 1/2 unit.

[3]Excludes unreported quantity valued at $1,257,000.

[4]Excludes unreported quantities valued at $17,497,000 in 1985 and $2,797,000 in 1986.

[5]Excludes unreported quantities valued at $57,411,000 in 1985 and $58,545,000 in 1986.

[6]Unreported quantity valued at $33,880.

[7]May include some arsenic.

COMMODITY REVIEW

METALS

Aluminum.—Production of primary aluminum dropped sharply to a record low since 1952 when two of the remaining three primary aluminum smelters closed their plants permanently in March. The Miike plant operated by Mitsui Aluminium Co. Ltd. and the Sakaide plant operated by Ryoka Light Metal Industries Ltd. stopped production in April. Japan, once the world's third largest primary aluminum producer with a 1.6-million-ton-per-year capacity in 1977, was reduced to an insignificant producer with only one plant having a 64,000-ton-per-year capacity and operated by Nippon Light Metal Co. Ltd. at Kanbara in Shizuoka Prefecture. The increased cost of electricity since the second oil crisis in 1979 and more imports of low-priced primary aluminum were the main factors for the decline.

In 1987, primary aluminum production by Mitsui Aluminium and Ryoka Light Metal was 4,982 tons and 3,892 tons, respectively. Production by Nippon Light Metal totaled 31,759 tons, which was 50% of its Kanbara plant capacity. As a result of a drastic reduction in domestic production and stronger domestic demand, imports of primary aluminum surged to a record high while stocks of domestic producers depleted

to 15,245 tons at yearend from 62,986 tons in 1986. Japan's domestic production of primary aluminum provided only 2% of domestic demand in 1987.

To meet domestic demand in 1987, Japan's imports of primary aluminum rose 36.5% to 1,657,566 tons, of which 1,370,949 tons was regular-grade ingot; 57,332 tons, high-grade ingot; and 229,285 tons, low-grade and aluminum alloy ingot. Australia remained Japan's largest supplier, accounting for 25% of imports, followed by Brazil, 15%; the United States, 14%; Venezuela, 12%; New Zealand, 11%; and Indonesia, 10%.

According to Sumitomo Corp., a Tokyo-based trading company, imports of primary aluminum and aluminum alloy from the spot market rose to 770,000 tons from 194,000 tons in 1986, those from long-term contracts rose to 500,000 tons from 420,000 tons in 1986, and those from overseas captive-import development projects declined to 560,000 tons from 586,000 tons in 1986.[6] The substantial increase in imports from the spot market after March 1987 was due to permanent closures of two domestic plants and a reduction in the tariff on primary aluminum from 9% to 5% effective in April.

Under an agreement between the Governments of Japan and the United States in October 1986, Japan was to cut further the tariff on imports of primary aluminum from 5% to 1% on April 1, 1988. However, in September, the Japan Aluminium Federation (JAF) asked the Government to eliminate the tariff on primary aluminum. JAF's action reportedly was part of its policy to secure stable supplies of primary aluminum and remove the obstacle to establishing a London Metal Exchange-designated warehouse of primary aluminum to Tokyo.[7]

Domestic demand for primary aluminum increased 14% to 2.1 million tons owing largely to an 11% increase in consumption by the aluminum rolling sector to 1.6 million tons and a 133% increase in consumption for secondary smelting to 155,866 tons. Consumption by other major sectors included 154,606 tons for aluminum casting and diecasting, 71,955 tons for wire and cable, and 34,832 tons for steel deoxidization. Exports of primary aluminum dropped further to 854 tons, of which 505 tons went to the Republic of Korea and 149 tons went to the United States. The yearend overall stocks of primary aluminum were 210,880 tons, of which 15,245 tons was held by producers, 92,872 tons was held by dealers and 97,763 tons was held by consumers. These levels were about the same at yearend 1986.

Because of the appreciation of the yen and low U.S. dollar-based prices of primary aluminum in the world market, Alumínio Brasilerio Ltda. (ALBRAS) of Brazil and P.T. Indonesia Asahan Aluminum (IN-ALUM) of Indonesia reportedly suffered losses and experienced difficulties in repaying interest and principal on their yen-denominated loans. In June, the Government of Japan, through the Overseas Economic Cooperation Fund, decided to provide financial assistance for these aluminum smelting projects. The financial assistance package to ALBRAS included $42.7 million in additional financing, lowering of interest rates on the existing loans to 5.0%-5.2% from 7.14%-7.6%, and extending repayment terms to 20 years from 15. The assistance package to IN-ALUM included $160 million in additional financing, lowering of interest rates to 5.0%-5.2% from 6.48%-8.45%, and extending repayment terms to 30 years from 20.[8]

Imports of bauxite dropped to 1,872,020 tons from 2,307,459 tons in 1986 owing to reduced domestic demand for metallurgical-grade alumina. Australia remained the dominant supplier, accounting for 60% of imports, followed by Indonesia, 26%; and Malaysia, 14%. The combined production of alumina by the Shimizu plant of Nippon Light Metal, the Yokohama plant of Showa Denko K.K., and the Kikumoto plant of Sumitomo Chemical Co. Ltd. dropped 41% to 357,981 tons. In 1987, exports of alumina also dropped from 384,472 tons in 1986 to 198,844 tons, of which 101,056 tons was aluminum oxide and 97,788 tons was aluminum hydroxide.

Despite a drastic decline in the domestic demand for metallurgical-grade alumina, demand for non-metallurgical-grade alumina reportedly rose considerably. According to JAF, the domestic demand for aluminum hydroxide by nonsmelting end users rose to 358,000 tons in 1985 from 278,200 tons in 1981. The principal consumers of aluminum hydroxide in nonsmelting areas in 1985 were the manufacturers of coagulant, 164,000 tons; fluorides, 39,000 tons; rubber and plastics, 25,000 tons; catalysts, 20,000 tons; and cleaning materials, 18,000 tons. The domestic demand for aluminum oxide by nonsmelting end users also rose to 270,000 tons in 1985 from 209,800 tons in 1981. The major consumers of aluminum oxide in nonsmelting areas in 1985 were the

manufacturers of refractory materials, 176,000 tons and alumina ceramics, 47,000 tons.

To meet the growing demand for alumina in nonsmelting areas, Japan imported 26,984 tons of non-metallurgical-grade alumina in 1987. The principal suppliers were the United States, 12,744 tons; Australia, 11,223 tons; the Federal Republic of Germany, 946 tons; France, 731 tons; Turkey, 550 tons; and China, 429 tons.

Chromium.—Domestic production of chromium ore and concentrate mainly by Nippon Chrome Industries Ltd. at its Wakamatsu Mine in Tottori Prefecture increased slightly from that of 1986. Japan continued to import 99% of its requirements for chromium ore and concentrate in 1987. These imports increased slightly to 674,743 tons despite reduced metallurgical-grade chromite consumption for ferrochromium. The major overseas suppliers were the Republic of South Africa, 454,757 tons; Madagascar, 81,227 tons; India, 39,499 tons; New Caledonia, 28,061 tons; and Albania, 24,957 tons.

Because of reduced domestic ferrochromium production resulting from the high cost of electricity, consumption of metallurgical-grade chromium ore and concentrate dropped to about 540,000 tons from 563,015 tons in 1987. Despite a tight supply of ferrochromium in the second half of 1987, the Uji plant in Kyoto Prefecture, operated by Awamura Metal Industries Co. Ltd., and the Sakata plant in Yamagata Prefecture, operated by Japan Metals & Chemical Co. Ltd. reportedly were shut down in April and October, respectively. As a result, imports of the ferroalloy surged to a record 427,711 tons in 1987. The Republic of South Africa remained the dominant supplier accounting for 59% of total imports. Others were India, 12%; the Philippines, 11%; Zimbabwe, 6%; and Brazil and Greece, 2% each. Import c.i.f. prices of ferrochromium rose to $0.46 per pound in October from $0.40 per pound in March. The higher import price, was caused by an unexpected strong demand by the stainless steel industry and a short-term tight supply of ferrochromium in the world market during the second half of 1987.

Cobalt.—Japan stopped normal-scale refining of cobalt in 1987. Nippon Mining Co. Ltd. and Sumitomo Metal Mining Co. Ltd. shut down their cobalt refining facilities at the Nikko plant in Ibaraki Prefecture and the Niihama plant in Ehime Prefecture, respectively, in 1986 owing to lack of raw materials. However, Sumitomo Metal Mining reportedly recovered 124 tons of cobalt metal from import nickel-matte residues at its Niiham plant in 1987.

Japan remained 100% dependent on imports to meet its domestic requirements for cobalt in 1987. Because of stronger demand for cobalt, imports of cobalt metal, including powder and flakes, reached a record high 4,557 tons, of which 3,818 tons was ingot and 739 tons was powder and flakes. The principal suppliers were Zaire, 3,236 tons; Zambia, 403 tons; Belgium, 401 tons; and Norway, 218 tons.

According to MITI's official statistics, consumption of cobalt rose to 1,907 tons from 1,651 tons in 1986 owing primarily to increased demand by makers of specialty steels and magnetic materials. In 1987, cobalt consumption by specialty steel producers was 493 tons; for magnetic materials, 427 tons; for catalysts, 281 tons; for carbide tool steels, 251 tons; and other, 455 tons.

As part of the ongoing investigation for deep ocean floor manganese nodules, seabed hydrothermal deposits, and cobalt-rich crusts by its research vessel, *No.2 Hakurei Maru*, MMAJ announced the discovery of several promising seabed cobalt-rich crust deposits in the north Pacific Ocean between the Minami-Tori Island of Japan and the Wake Island of the United States in late 1987. According to MMAJ, seabed samples collected by the vessel assayed 25.0% manganese, 0.9% cobalt, 0.5% nickel, and 0.1% copper.[9]

Copper, Lead, and Zinc.—Mine production of copper, lead, and zinc dropped sharply to record-low levels since 1947, 1955, and 1960, respectively. The further decline in production of these ores was caused by the closure of four major mines in 1987 resulting from the higher yen which made domestic ore and concentrate less competitive.

The Hosokura Mine in Miyagi Prefecture, a lead-zinc operation of Hosokura Mining, was closed in February. The Akenobe Mine in Hyogo Prefecture, a copper-tin-zinc operation of Akenobe Mining, and the Syakanai Mine in Akita Prefecture, a copper-lead-zinc operation of Syakanai Mining, were closed in March. The Nakatatsu Mine in Fukui Prefecture, a lead-zinc mine operation of Nippon Zinc Mining, was closed in September.

The following mines remained in operation throughout 1987: the Hanaoka Mine in Akita Prefecture, Japan's largest nonferrous metal mine operated by Hanaoka Min-

ing Co. Ltd.; the Kamioka Mine in Gifu Prefecture, Japan's second largest nonferrous metal mine operated by Kamioka Mining and Smelting Co. Ltd.; the Kamaishi Mine in Iwate Prefecture, a copper-iron ore mine operated by Shin-Kamaishi Mining Co. Ltd,; the Toyoha Mine in Hokkaido Prefecture, a lead-zinc mine operated by Toyoha Mining Co. Ltd.; the Kosaka Mine in Akita Prefecture, a copper-lead-zinc mine operated by Uchinotai Mining Co. Ltd.; and the Yatani Mine in Yamagata Prefecture, a lead-zinc mine operated by Yatani Mining Co. Ltd. These mines, survivors of two major restructuring programs in 1983 and 1986, were considered to have sufficient ore reserves to continue efficient operations.

In April, a new nonferrous metal mine, the Nurukawa Mine, was brought into production by Uchinotai Mining Co., a subsidiary of Dowa Mining Co. Ltd. The mine, in south-central Aomori Prefecture, is about 1 kilometer west of Lake Towada in northern Akita Prefecture. The kuroko (polymetallic black ore) deposit was first discovered by MMAJ in 1974. Dowa Mining began underground drifting and drilling in 1982, started mine development in 1985 and completed development in November 1986. The ore reserves at the mine were estimated at 1 million tons, of which 950,000 tons are black ore averaging 0.9% copper, 5% lead, 10% zinc, plus 10 grams of gold and 150 grams of silver per ton of ore. The remaining 50,000 tons are gold ore averaging 13.3 grams of gold per ton of ore.[10]

According to Uchinotai Mining, the deposit occurs at the top of the Lower Hayasemori formation and consists of 5 ore bodies. The company started mining at the No. 5 ore body in April at the rate of 4,000 tons per month of black ore averaging 0.80% copper, 4.26% lead, 9.14% zinc, and 7.20 grams of gold and 135 grams of silver per ton of ore; and 1,000 tons per month of gold ore averaging 9.00 grams of gold and 40 grams of silver per ton of ore plus 1.17% copper, 2.36% lead, and 2.10% zinc. The ore was transported by battery-operated locomotives through a 1,635-meter adit to the surface. There it went into dump trucks for transport to the company's Kosaka milling and smelting facilities in Akita Prefecture.

Japan's production of copper, lead, and zinc ore provided 2.4%, 10.4%, and 24.9%, respectively, of its smelters' requirements in 1987. To meet its smelters' requirements, Japan imported 2,981,054 tons of copper ore and concentrate, 294,728 tons of lead ore and concentrate, and 974,026 tons of zinc ore and concentrate in 1987. The principal suppliers of copper ore and concentrate were Canada, 976,114 tons; the United States, 389,603 tons; the Philippines, 343,601 tons; Chile, 277,873 tons; Papua New Guinea, 264,239 tons; and Indonesia, 229,256 tons. The principal suppliers of lead ore and concentrate were Canada, 101,327 tons; Australia, 80,474 tons; the Republic of South Africa, 35,265 tons; and Peru, 34,288 tons. The principal suppliers of zinc ore and concentrate were Australia, 439,206 tons; Peru, 209,280 tons; and Canada, 203,035 tons.

Production of refined copper continued its upward trend and reached a new high since 1984 following an unexpected strong demand in the second half of 1987. Capacity utilization of the copper smelting and refining industry averaged 79%. As a result of stronger demand in 1987, imports of refined copper rose 28% to 347,667 tons. The major suppliers were Zambia, 167,592 tons; Chile, 65,419 tons; the Philippines, 43,883 tons; Peru, 18,159 tons; and Australia, 16,795 tons. Japan also imported 27,914 tons of blister copper, of which 26,916 tons came from Peru.

Production of refined lead increased slightly owing to the growing demand by the batteries sector. Production of slab zinc decreased considerably because of reduced domestic zinc ore production. Capacity utilization of the lead and zinc smelting and refining industries averaged 86% and 77%, respectively. To meet domestic demand, Japan imported 21,030 tons of primary lead, principally from Australia, 8,213 tons; Mexico, 4,044 tons; China, 2,623 tons; and Peru, 2,422 tons. Japan also imported 105,035 tons of slab zinc, principally from North Korea, 36,203 tons; the Republic of Korea, 24,495 tons; Australia, 15,618 tons; and China, 13,279 tons.

Domestic refined copper consumption rose 5% to 1,431,336 tons, of which 952,860 tons was consumed by the wire and cable sector, 461,739 tons by the brass mill sector, and 16,733 tons by manufacturers of copper powder, coins, and copper alloys. Exports of refined copper, mainly to Taiwan and the Republic of Korea, dropped 14% below those of 1986 to 52,403 tons because of the tight domestic market situation in the second-half of 1987. As a result of stronger domestic demand, the overall stocks of refined copper held by producers, fabricators, and dealers dropped 12% by yearend to

90,950 tons or equivalent to less than 1 month of refined copper consumption in 1987.

Domestic consumption of primary lead rose slightly to 275,524 tons mainly because of increased consumption by the storage battery sector, which accounted for 62% of demand. Exports of primary lead dropped sharply to 14,167 tons from 24,167 tons in 1986. As a result of stronger demand and reduced domestic production and imports, the stocks of primary lead held by producers, consumers, and dealers dropped 28% by yearend to 25,716 tons or equivalent to about 1 month of primary lead consumption in 1987.

Domestic consumption of slab zinc rose 5% over 1986 to 749,539 tons owing to a 7.6% increase in demand by the galvanizing sector, which accounted for 61% of consumption. Exports of slab zinc rose 122% to 51,854 tons resulting from increased exports to China, Taiwan, and the United States. By yearend, the overall stocks of slab zinc dropped 10% to 89,818 tons or equivalent to about 1.5 months' of slab zinc consumption in 1987.

To secure their smelters' raw material requirements, a group of major copper producers led by Nippon Mining Co. Ltd. and Mitsubishi Metal Corp. signed an agreement in August with Ok Tedi Mining Ltd. of Papua New Guinea to import 60,000 tons per year of copper concentrate for the year starting in October 1987 and increasing to 230,000 tons per year during the following 7 years. Papua New Guinea, already exporting about 265,000 tons per year of copper concentrate from the Bougainville Mine to Japan, will displace the Philippines and Chile as the third largest supplier of copper concentrate to Japan following Canada and the United States in 1988.

Nittetsu Mining Co. Ltd., a major partner of Hibi copper smelter at Tamano, Okayama, reportedly started in September the development of the El Lobre copper deposit in Medellin, Colombia. The $17 million project for producing 96,000 tons per year of concentrate was a joint venture of Nittetsu Mining and C. Itoh & Co. Ltd. of Japan and Minas El Lobre Ltda. of Colombia. The El Lobre copper project was expected to supply Nittetsu Mining 14,000 tons per year of copper concentrate when production starts in mid-1989.

In early 1987, Mitsui Mining and Smelting Co. Ltd. (MMSC), Japan's largest producer of slab zinc, reportedly acquired about 3% equity of Cominco Ltd. of Canada. Following the acquisition, six Japanese zinc smelters led by MMSC and Tono Zinc Co. Ltd., reportedly, negotiated a long-term contract with Cominco to import 70,000 to 100,000 tons per year of zinc concentrate from the Red Dog Mine in Alaska beginning in 1991. The Red Dog Mine, owned by Cominco, was expected to start production at the rate of 500,000 tons of lead-zinc concentrate per year in 1991. The ore reserves at the mine were estimated at 77 million tons averaging 5.6% lead, 17.1% zinc, and 82.3 grams of silver per ton of ore.

Gallium.—Japan remained one of the world's three leading producers and the largest consumer of gallium metal. Production of high-purity gallium metal was estimated at 20 tons, of which 10 tons was recycled scrap. Consumption of gallium metal including metallic compounds was estimated at 36 tons in 1987. To meet domestic demand, Japan imported 11 tons of high-purity primary gallium and 5 tons of intermediate-purity gallium metal.

Table 4.—Japan: Estimated supply of gallium

(Kilograms)

	1985	1986	1987
Domestic production:			
Primary	10,000	10,000	10,000
Secondary	10,000	9,000	10,000
Imports:			
High-purity:			
France	5,264	2,700	5,600
Germany, Federal Republic of	3,200	4,200	4,900
Switzerland	50	100	740
Intermediate-purity:			
Canada	--	300	300
China	4,000	5,100	2,000
Czechoslovakia	2,285	450	1,100
Hungary	1,800	750	1,500
Total	36,599	32,600	36,140

Source: The Rare Metal News (Tokyo). No. 1444, Apr. 1, 1988, p. 3.

Domestic primary producers were Dowa Mining having a 7-ton-per-year capacity and Sumitomo Chemical Co. Ltd. having a 10-ton-per-year capacity. Dowa Mining extracted 4- to 7-nines-purity gallium from zinc residue, using the ion exchange resins process at its Kosaka refinery in Akita Prefecture. Sumitomo Chemical also extracted 4- to 7-nines-purity gallium using the Bayer liquor process at its Niihama plant in Ehime Prefecture. Secondary producers included Dowa Mining, Sumitomo Chemical, Rasa Industries Co. Ltd., and Nichia Chemical Co. Ltd. Most secondary producers extracted gallium metal from

scrap of gallium arsenide, gallium phosphate, and compound semiconductors using chloride recycling technology. According to an industry source, recycled scrap in 1986 accounted for 30% of the domestic gallium consumption which was estimated at 32 tons.[11]

In January, Ote Metal Co. Ltd. reportedly started recycling gallium arsenide using a low-cost chloride process at the Onahama plant owned by its parent company, Mitsubishi Metal, with a monthly capacity of 500 kilograms of high-purity gallium. In July, Sumitomo Metal Mining also introduced a low-cost chloride recycling technique to extract high-purity gallium at its Isoura plant near the city of Niihama in Ehime Prefecture with a monthly capacity of 300 kilograms, which could be doubled if sufficient scrap supplies were secured.

In January, the National Research Institute for Metals of Japan and Beijing University of Iron and Steel Technology of China signed an agreement for a 4-year joint research program to develop technology for extracting and separating gallium, titanium, and vanadium from complex iron ore mined from the Panzhihua deposit in Sichuan Province of China. The joint research program was expected to end in March 1991. Japan has imported between 2,000 and 5,000 kilograms per year of intermediate-grade gallium with a purity of 3 to 4 nines from the Zhangdian alumina plant in Shandong Province of China. According to a Japanese source, gallium production by the plant was estimated at 7 tons per year. Additionally, the Zhengzhou alumina plant in Henan Province of China planned to produce 2 to 3 tons of crude gallium beginning in 1986.[12] Musto Exploration Ltd. of Canada, reportedly, started to export to Japan in 1986 about 300 kilograms per year of gallium with a purity of 3 to 4 nines. The principal overseas suppliers in 1985-87 of high-grade gallium with a purity between 6 and 7 nines were International Gallium GmbH of the Federal Republic of Germany, Rhône-Poulenc S.A. of France, and Alcan Electronic Materials of Switzerland.

Gold and Silver.—Despite increased output from the Hishikari gold mine, mine production of gold and silver declined substantially resulting from the closure of two major copper-lead-zinc mines in 1987. The two mines recovered a considerable amount of gold and silver as byproducts. In 1987, Japan's mine production of gold was equivalent to 15% of its requirement for domestic gold metal production and 2.4% of domestic gold demand, and that of silver was equivalent to 15% of its requirement for domestic silver metal production and 10% of domestic silver demand.

Domestic metal production of gold and silver both broke the previous record-high level as a result of processing more imported raw materials primarily copper concentrates. Gold metal production by source of raw material was 25% from domestic ore, 62% from imported ore, and 13% from scrap and other. Silver metal production by source of raw material was 17% from domestic ore, 52% from imported ore, and 31% from scrap and sources. Domestic metal production of gold and silver was 16% and 64%, respectively, of the domestic demand in 1987.

To meet demand, Japan imported 7.7 million troy ounces of gold and 20.2 million troy ounces of silver in 1987. The major suppliers of gold were Switzerland, 3,272,111 ounces; Australia, 1,180,413 ounces; the U.S.S.R., 906,612 ounces; Canada, 671,628 ounces; the United Kingdom, 621,682 ounces; and the Republic of South Africa, 498,616 ounces. The principal suppliers of silver were Mexico, 11.5 million ounces; Peru, 4.3 million ounces; and the Republic of Korea, 2.7 million ounces.

According to industry sources, domestic consumption of gold declined to 11.3 million ounces from 11.6 million ounces in 1986 because of reduced private hoarding in 1987. Of the gold consumed, 38% was for private hoarding, 24% for jewelry; 15% for communication and electrical equipment; 3% for dental and medical uses; and 20% for arts and crafts, pottery, watches, and other. Consumption of silver rose to 92.2 million ounces from 89.5 million ounces in 1986 resulting from a 9% increase in demand by the photographic materials sector. Of the silver consumed, 56% was for silver-nitrate-sensitive film; 9% for other silver nitrate; 8% for electric contact points; 6% for fabricated silver products; 5% for plating; and 16% for silverware, jewelry, dental and medical uses, and other.

The Hishikari Mine, owned and operated by Sumitomo Metal Mining in Kagoshima Prefecture of southern Kyushu, reportedly made further progress in 1987. The average daily output of ore was raised from 220 tons to 250 tons with ore grade averaging 2.47 ounces of gold and 1.42 ounces of silver per ton of ore. Gold and silver production in 1987 was estimated at 214,500 ounces and

123,300 ounces, respectively. According to Sumitomo Metal Mining, the ore was first crushed and delivered to its Toyo copper smelter near the city of Niihama in Ehime Prefecture. For the 29 months ending in December 1987, ore output totaled 190,000 tons averaging 2.73 ounces of gold and 1.93 ounces of silver per ton of ore. According to a survey conducted in 1986 covering 147 primary gold mines in the world, the Hishikari Mine was ranked the lowest-cost producer. The estimated average mining cost for the Hishikari Mine was $30 per ounce of gold.[13]

Indium.—Japan was one of the top two producers and the largest consumer of indium metal in the world. Because of increased use of indium by the electronic industry, both domestic production and imports surged to all time highs in 1986 and again in 1987. Japan's average import c.i.f. price in 1987 was two times that of 1986. According to Japanese industry sources, strong domestic demand, speculative purchases and tight supply all contributed to the unprecedented rise in the world market price of indium in 1987.

Table 5.—Japan: Estimated supply and demand for indium

(Kilograms)

	1985	1986	1987
Domestic production	16,000	18,000	27,200
Imports	8,200	21,500	31,000
Total supply	24,200	39,500	58,200
Demand:			
Semiconductors	3,700	6000	7,200
Transparent electrode	6,300	10,000	13,000
Fluorescent materials	--	6,000	7,800
Fusible alloys solder	2,500	4,000	5,200
Dental amalgams	2,900	3,000	3,000
Electrical contacts	1,200	2,000	2,000
Others	5,400	9,200	10,200
Total demand	22,000	40,200	48,400

Source: The Rare Metal News (Tokyo). No. 1444, Apr. 1, 1988, p. 2.

Domestic indium metal with up to 4-nines purity was produced principally by Nippon Mining, which extracted indium at its Saganoseki plant in Oita Prefecture of northeastern Kyushu from zinc slag generated at its affiliated zinc smelters in Japan. The lead-zinc ore containing gold, indium, and silver came mostly from the Toyoha Mine in Hokkaido. To stabilize the market price and meet growing domestic demand, Nippon Mining expanded its indium production capacity from 18 to 24 tons per year in July. Dowa Mining also extracted between 2 and 3 tons per year of indium with 4-nines purity at its Kosaka plant in Akita Prefecture using leached residue from its affiliated Iijima zinc smelter of Akita Smelting Co. Ltd. in Akita Prefecture. The black ore, containing copper, lead, and zinc and byproduct gallium and indium, was mostly from the Kosaka Mine in Akita Prefecture. In addition, MMSC and Sumitomo Metal Mining, reportedly also produced 20 to 30 kilograms of high-purity indium in 1987.

Imports of indium rose to 31,034 kilograms from 21,514 kilograms in 1986. Japan's import c.i.f. price of indium ingot averaged $194 per kilogram compared with $97 per kilogram in 1986. According to Japanese trade data, two-thirds of the indium was imported in the first half of 1987, when import c.i.f. prices jumped from $98.52 per kilogram in early January to $246.88 per kilogram in late June. The import price peaked at $334.89 per kilogram in late July, and that high level extended until yearend. In 1987, the major supplying countries were the United States, 12,240 kilograms; China, 8,520 kilograms; Canada, 2,499 kilograms; Belgium, 2,498 kilogram; and the United Kingdom, 2,292 kilograms.

Iron and Steel.—Domestic production of iron ore and roasted pyrite remained insignificant. Japan continued to import essentially all of its iron ore requirements to meet the demand of its iron and steel industry. Imports of both iron ore and ferruginous manganese ore declined resulting from further reductions in iron ore consumption by the blast furnace sector in 1987.

Imports of iron ore dropped to 112.0 million tons from 115.2 million tons in 1986. The major iron ore suppliers were Australia, 43.4 million tons; Brazil, 26.8 million tons; India, 20.3 million tons; the Republic of South Africa, 5.6 million tons; Chile, 4.5 million tons; and the Philippines, 4.2 million tons. Imports of ferruginous manganese ore dropped from 519,355 tons in 1986 to 344,254 tons, of which 219,790 tons was from the Republic of South Africa and 124,464 tons was from India. The import c.i.f. price of iron ore averaged $23.37 per ton compared with $23.95 per ton in 1986. In 1987, the import c.i.f. price of iron ore from Australia averaged $21.86 per ton, down 84 cents from that of 1986; from Brazil $24.40, down 86 cents; and from India $21.05, down 56 cents.

Consumption of iron ore decreased to 119.8 million tons from 122.4 million tons in 1986 because of lower pig iron production.

Production of pig iron, mostly by blast furnace, declined to 73.4 million tons from 74.7 million tons in 1986 owing to increased consumption of imported pig iron and iron and steel scrap for crude steel production. The output of pig iron was equivalent to 69% of the industry's installed capacity in 1987.

Japan remained the second largest crude steel producer in the world accounting for 13.4% of the world's production in 1987. Despite the lower level of steel exports and continued increase in imports, production of crude steel went up slightly to 98.5 million tons. Increased Government spending on public works reportedly was the major factor that prevented the ailing iron and steel industry from further decline. The output of crude steel in 1987 was equivalent to 65% of the industry's installed capacity of 152.5 million tons per year.

Despite a huge loss in the previous fiscal year because of lower prices and sales, the iron and steel industry overcame difficulties brought about by the yen in 1987. Higher prices of iron and steel products and strong domestic demand in the second half of 1987 helped the Japanese steelmakers maintain their 65% capacity utilization and improve their earnings substantially. Because of the sharp turnaround in the domestic and overseas steel markets in the second half, major Japanese steelmakers reportedly revised their short-term outlook upward and postponed parts of their restructuring program announced in early 1987.

Table 6.—Japan: Crude steel production and rank of the top seven companies

	Output (million metric tons)		Rank among market economy countries	
	1986	1987	1986	1987
Nippon Steel Corp	26.26	26.03	1	1
Nippon Kokan K.K	11.21	11.28	5	7
Kawasaki Steel Corp	10.10	10.13	8	12
Sumitomo Metal Industries Ltd	10.11	10.12	7	13
Kobe Steel Ltd	5.94	5.88	19	17
Nisshin Steel Co. Ltd	3.21	3.36	36	35
Tokyo Steel Manufacturing Co. Ltd	3.03	3.16	37	37
Total	69.86	69.96	XX	XX

XX Not applicable.

Source: Metal Bulletin (London). No. 7260, Feb. 15, 1988, p. 23.

According to the Japan Iron and Steel Federation (JISF), apparent domestic consumption of steel in terms of crude steel equivalence rose 8.3% to 75.8 million tons in 1987. However, because of the higher level of the yen in 1987, exports of steel in crude steel equivalence declined by 11.9% to 28 million tons while imports continued to increase by 50.6% to 5.3 million. As a result of acute shortages of steel products consumed by the growing construction industry, domestic prices of hot-rolled sheet and small bars rose by 28% and 91% to $569 and $436 per ton, respectively, during the second half of 1987.[14]

According to MITI, exports of iron and steel products dropped 15.3% to 25.7 million tons. Exports, as a percentage of crude steel production, declined to 28.5% from 32.4% in 1986 and 33.2% in 1985. A stronger yen making Japanese steel products more expensive was the single most important reason for a further decline in steel exports. However, because of higher export prices, export earnings decreased only 0.8% below 1986 to $13 billion. In 1987, iron and steel products were exported principally to China, 5.8 million tons; the United States, 4.3 million tons; Taiwan, 2.4 million tons; the Republic of Korea, 2.3 million tons; the U.S.S.R., 2 million tons; and Thailand, 1 million tons. Of the exports of iron and steel products to the United States, 3.6 million tons was ordinary carbon steel, 272,697 tons specialty steels, 89,351 tons wire and wire products, 86,861 tons semifinished steels, and 282,986 tons other products.

Imports of iron and steel rose sharply from 5.3 million tons in 1986 to 7.5 million tons, which were valued at $2.5 billion. Of the imports, 2.1 million tons was hot-rolled strip, 1.4 million tons was pig iron, 1.1 million tons was plates, and 1.0 million tons was ferroalloys. The major suppliers were

the Republic of Korea, 2.1 million tons; Brazil, 800,000 tons; China, 500,000 tons; the U.S.S.R. and Taiwan, 400,000 tons each. Imports from the United States totaled 51,407 tons valued at $67.4 million in 1987. According to JISF, steel imports in crude steel equivalence accounted for 7% of apparent domestic steel consumption compared with 5% in 1986 and 4% in 1985.

In June, a special report on future prospects for the iron and steel industry was completed by an MITI's advisory committee. The committee reporting to MITI's Basic Industries Bureau said that more extensive restructuring and research and development to improve production technology are vital to the future of the industry. The committee also recommended Government subsidies to help industry to restructure and modernize its production technology.

The report indicated that steel production for the domestic market was expected to fall because of declining exports and rising imports caused by the stronger yen and increasing substitution of new materials for steel caused by technological advance.

Manganese.—All of Japan's requirements for manganese were met by imports in 1987. The only domestic producer, Chuugai Mining Co. Ltd., permanently shut down its lead-manganese-zinc operations in May 1986 at Jokoku in Hokkaido.

In 1987, Japan imported 1,216,509 tons of manganese ore and concentrate and 19,899 tons of high-grade manganese dioxide ore for its iron and steel industry and manganese metal production. The Republic of South Africa and Australia remained the dominant suppliers, accounting for 46% and 41%, respectively, of manganese ore and concentrate imports. The suppliers of manganese dioxide ore were Australia, 6,377 tons; Mexico, 5,555 tons; Congo, 4,500 tons; and China, 3,467 tons.

The further decline in imports of manganese ore and concentrate during 1986-87 reportedly was attributable to cutbacks in crude steel production, reduced consumption of low-grade manganese ore, and increased substitution of high-grade manganese ore for ferromanganese in steelmaking through technological improvements. Consumption of manganese ore and concentrate totaled 974,956 tons, of which 935,410 tons was consumed by the iron and steel industry. By yearend, stocks of manganese ore held by the iron and steel industry rose slightly from 466,262 tons at yearend 1986 to 505,595 tons at yearend 1987 or equivalent to a 6-month supply.

According to estimates by an industry source, production of metallic manganese by Toyo Soda Manufacturing Co. Ltd. and Chuo Denki Kogyo Co. Ltd. dropped to 3,700 tons from 3,900 tons in 1986 because of reduced consumption by the makers of specialty steel. However, consumption by the makers of nonferrous alloys is expected to increase in the future.

Nickel.—Japan continued to import 100% of its nickel requirements in 1987 in the form of nickel ore and matte, ferronickel, and refined nickel. Japan remained the world's third largest producer of ferronickel and nickel metal and was a major importer of nickel ore and matte and refined nickel. Because of a significant increase in domestic demand for nickel, imports of refined nickel surged to a record-high in 1987.

Imports of nickel ore for production of ferronickel rose slightly to 2,926,857 tons. Indonesia, New Caledonia, and the Philippines remained the three suppliers, accounting for 40%, 37%, and 23%, respectively. Imports of nickel matte for production of refined nickel and nickel oxide sinter decreased slightly to 53,567 tons, of which 62% was supplied by Indonesia and 38% by Australia.

Production of ferronickel increased slightly to 203,143 tons containing 49,405 tons of nickel, of which 50% was produced by Pacific Metals Co. Ltd.; 21% by Hyuga Smelting Co. Ltd., a subsidiary of Sumitomo Metal Mining; 20% by Nippon Yakin Kogyo Co. Ltd.; and 9% by Oita Nickel Co. Ltd., a subsidiary of Nippon Mining. In October, Nippon Mining shut down indefinitely its Oita nickel smelter at Saganoseki in Oita Prefecture of northeast Kyushu because of losses resulting from high costs of nickel ore and of energy and because of furnace problems. Nippon Mining took this action despite tight domestic and world market. The Oita smelter, capable of producing 9,600 tons per year of nickel content, produced 4,262 tons nickel in ferronickel for the first 9 months of 1987. To meet the domestic demand by the specialty steel industry, Japan also imported 29,935 tons of ferronickel in 1987, principally from New Cale-

donia, 44%, and the Dominican Republic, 31%.

Production of refined nickel declined 13%, due to closure of Nippon Mining's Nikko nickel plant at Hitachi in Ibaraki Prefecture in September 1986. Nickel refining in 1987 was by Sumitomo Metal Mining and Shimura Kako Co. Ltd. Production of nickel oxide sinter by Nippon Nickel Co. Ltd. and Tokyo Nickel Co. Ltd. remained at 19,000 tons in 1987. Tokyo Nickel was doubling the capacity to 32,000 tons per year at its Matsuzaka plant in Mie Prefecture. Upon completion of the expansion program in mid-1988, Tokyo Nickel reportedly will terminate its toll smelting agreement with Nippon Nickel.

Because of reduced domestic production and an unexpected stronger demand by the specialty steel, nonferrous alloy, and battery industries in the second half of 1987, imports of refined nickel including flakes, foil, powder, and wire rose sharply from 28,353 tons in 1986 to 46,085 tons. The principal suppliers in 1987 were the U.S.S.R., 10,643 tons; Canada, 9,651 tons; Zimbabwe, 6,016 tons; China, 5,074 tons; the United Kingdom, 3,977 tons; Australia, 3,866 tons; and Norway, 3,676 tons. Imports of refined nickel from China rose to more than 5,000 tons from 1,600 tons in 1986 and only 10 tons in 1985. According to Japanese sources, China produced 27,000 tons of refined nickel in 1987 and planned to double its nickel refining capacity at Jinchuan in Gansu Province to 40,000 tons per year in the next 2 to 3 years. By 1990, China could become an important supplier of refined nickel to Japan.

As a result of a tight supply in the world market, the average monthly nickel price on the London Metal Exchange rose from $1.62 per pound in December 1986 to $2.02 per pound in June and $3.48 per pound in December. However, because of the 14% appreciation in the yen in 1987, Japan's import c.i.f. price averaged $2.07 per pound compared with $1.96 per pound in 1986.

Consumption of refined nickel rose to 57,927 tons from 44,509 tons in 1986 owing mainly to a 44% rise in demand by the specialty steel industry. By major consumer, nickel consumption for specialty steel rose from 27,118 tons in 1986 to 39,064 tons; for plating, 5,938 tons to 6,047 tons; for nonferrous alloys, 3,218 tons to 3,671 tons; for magnetic materials, from 3,056 tons to 3,267 tons; and for storage batteries, 1,976 tons to 2,384 tons. Exports of refined nickel dropped 16% to 351 tons in 1987. However, the stocks held by producers, distributors, and consumers at yearend rose 12% to 15,255 tons or equivalent to a 3-month supply in 1987.

Rare Earths.—Japan was a major world consumer of rare earths, however, it relied on imports for all its rare-earth requirements. For the first time, MITI began publishing the combined production of 10 rare-earth commodities produced by 9 domestic companies that used imported raw material in 1987. Imports of rare earths included mainly rare-earth concentrates, crude rare earths, and separate rare-earth products. Consumption of rare-earth products in Japan covered a wide range of applications such as cerium oxide for polishing optical lenses, europium and yttrium oxides for color cathode ray tubes, lanthanum and neodymium oxides for ceramic condensers and optical lenses, and samarium and neodymium oxides for rare-earth magnets.

According to MITI, the combined output of cerium oxide, europium oxide, gadolinium oxide, lanthanum oxide, neodymium fluoride, neodymium oxide praseodymium oxide, samarium oxide, terbium oxide, and yttrium oxide was 3,053 tons. The nine producers were Mitsubishi Chemical Industries Ltd., MMSC, Nippon Yttrium Co. Ltd., Nissan Kigenso Co. Ltd., Santoku Kinzoku Kogyo Co. Ltd., Seimi Chemical Co. Ltd., Shi-Etsu Chemical Co. Ltd., Shin Nippon Kinzoku Kagaku Co. Ltd., and Tohoku Kinzoku Kagaku Co. Ltd.

In 1987, imports of rare-earth concentrate in the form of bastnasite, monazite, and xenotime totaled 2,330 tons, of which 862 tons was from China; 557 tons from the United States; 511 tons from Malaysia; and the remainder principally from India and other countries. Imports of crude rare earths totaled 3,752 tons, of which 1,497 tons was from China, 826 tons from the United States, 718 tons from India, 625 tons from Brazil, and 86 tons from Malaysia. Imports of rare-earth products were 331 tons of yttrium oxide, 258 tons of cerium oxide, 102 tons of lanthanum oxide, 278 tons of rare-earth metals, and 4,430 tons of rare-earth compounds. The principal suppliers were China for yttrium oxide, rare-earth metals, and rare-earth compounds; France for lanthanum oxide and rare-earth compounds; and the United States for cerium oxide and rare-earth compounds. Japan also imported from France 288 tons of neodym-

ium oxide, neodymium fluorides, and neodymium carbonate; 167 tons of samarium oxides, and 277 tons of cerium hydroxides.

According to Japan Chemical Week, the estimated demand for rare-earth products in 1987 were 380 tons for catalysts, 2,800 tons for cerium oxide, 10 tons for europium oxide, 360 tons for lanthanum oxide, 280 tons for mischmetal, 60 tons for rare-earth fluoride, 340 tons for samarium oxide, 240 tons for yttrium oxide, and 400 tons for other rare-earth oxides.[15]

To secure and diversify the supply sources of its growing demand for rare-earth minerals, MMAJ signed an agreement with the Department of Natural Resources of Kenya in July for a 3-year joint rare earths exploration project in a 10,000-square-kilometer area of Homabay, Kenya. Under a 5-year joint exploration agreement with China in 1986, MMAJ sent a team to China in October to explore for rare earths in southwestern Guangdong Province. Mitsubishi Corp. of Japan and the British Petroleum Co. of the United Kingdom reached an agreement with China in November to investigate rare-earth resources in Gansu, Sichuan, Yunnan, and Qinghai Provinces of China as well as in Tibet and the Xinjian autonomous region in West China. The joint investigation was scheduled to start in early 1988. In late 1987, Inoue Japan Research Inc. of Japan planned to collaborate with Beijing University and Shanghai Jiaotong University of China to conduct research on using rare earths in magnets and ceramic materials.

Tin.—Japan stopped tin mining when the Akenobe Mine in Hyogo Prefecture was shut down in February. The mine has been producing tin for the past 120 years. According to Mitsubishi Metal, its owner, the mine produced 238,000 tons of ore in 1986, averaging 0.34% tin, 1.37% copper, and 4.67% zinc. The mine was closed because of mounting losses resulting from low tin prices and the appreciation of the yen in 1987.

Despite a lack of domestic tin ore and concentrate, Mitsubishi Metal continued to produce tin metal at the Ikuno plant of its Naoshima copper-tin smelting and refining complex in Kagawa Prefecture of North Shikoku. The smelter reportedly used other residual materials and imported ore for crude tin production in 1987.

To meet domestic demand, Japan imported 31,997 tons of refined tin mainly from Malaysia, 53%; Thailand, 20%; Indonesia, 16%; and China, 8%. Domestic consumption of tin rose 3.5% to 32,620 tons, of which 42% was for silver solder, 31% for tinplate, 5% for electric wire and cable, 4% for brass mill products, and 18% for other. Japan exported only 87 tons of refined tin in 1987.

Titanium.—Japan continued to rely on imports for its raw material requirements mainly for producing titanium metal and oxide. In 1987, it imported 570,377 tons of titanium ore and concentrate and 88,387 tons of titanium slag. Australia was the supplier of rutile for sponge metal and ferrotitanium, while the Republic of South Africa was the supplier of titanium slag for oxide production. The principal suppliers of ilmenite for production of oxide and for refractory material in steelmaking were Australia, India, Malaysia, and Sri Lanka.

Despite a moderate improvement in exports, production of titanium sponge metal continued to move downward because of a high inventory, stagnant domestic demand, and further appreciation of the yen. According to the Japan Titanium Society, domestic demand for titanium sponge, including producer in-house consumption, was 9,586 tons compared with 9,556 tons (revised) in 1986 while exports rose 25.7% to 4,250 tons. In 1987, the major overseas buyers of titanium sponge metal were the United Kingdom, 1,593 tons; the United States, 960 tons; France, 765 tons; the Federal Republic of Germany, 569 tons; and the Netherlands, 283 tons.

Production of titanium dioxide pigment continued to increase owing to a steady growth in consumption by the paint and coating, printing ink, and paper manufacturing industries. According to the Japan Titanium Dioxide Industry Association, domestic demand for titanium dioxide was estimated at 165,990 tons compared with 162,738 tons in 1986. Domestic consumption by end user in 1986 was 85,451 tons for paint and coatings, 26,813 tons for printing ink, 14,215 tons for synthetic resin, 12,073 tons for paper manufacturing, 4,695 tons for chemical fibers, 3,869 tons for rubber, and 15,622 tons for other. Exports of titanium dioxide totaled 65,464 tons in 1986 and were estimated to be 66,780 tons in 1987.

In May, Ishihara Sangyo Kaisha Ltd. (ISK) started construction of its first overseas titanium dioxide plant in Singapore and established a wholly owned subsidiary, ISK Singapore Pte. Ltd. to operate the plant. JGC Corp. of Japan was selected as the prime contractor for the $100 million

phase-1 project to build a 36,000-ton-per-year titanium dioxide plant. Phase 1 was expected to be completed in mid-1989. The 100,000-ton-per-year ilmenite beneficiation plant at North Capel, Western Australia, where ISK has a 15% stake, was opened officially in February. Under a long-term agreement, the Australian plant will deliver 40% of its annual output to ISK's Singapore titanium dioxide plant, beginning in 1989.[16]

INDUSTRIAL MINERALS

Cement.—Despite a slight improvement in domestic demand, production moved lower. The higher yen has resulted in more imports of low-price foreign cement and less exports. According to the Cement Association of Japan (CAJ), the industry's production capacity was down to 98 million tons per year with only 41 plants operating. The industry's employment was reduced by 7% to 7,740. To survive competition from overseas, the industry reportedly would reduce its annual capacity by another 12 million tons with tax and other incentives to be offered by the Government in the next few years.

Exports of cement dropped 22% to 4.3 million tons while imports rose 70% to 2.5 million tons. The Republic of Korea and Taiwan remained the major sources of low-price imported cement. According to an industry source, foreign cement in September was $14 to $21 per ton cheaper than domestic cement in the Tokyo area. Cutbacks in construction in Saudi Arabia and Kuwait continued to affect exports. Since 1986, exports of cement went mostly to China, Hong Kong, Pakistan, Singapore, Sri Lanka, and the United States.

Consumption of cement rose slightly to 68.6 million tons compared with 67.7 million tons in 1986. According to CAJ, 69% was used for ready-mixed concrete; 16% for concrete products, 5% for civil engineering, 3% for building construction, and 7% for other.

Table 7.—Japan: Cement production in fiscal year 1986, by marketing group and company

(Thousand metric tons)

Group and company	
Andes Group:	
Aso Cement Co. Ltd	917
Denki Kagaku Kogyo Co. Ltd	2,058
Hachinohe Cement Co. Ltd	1,295
Kanda Cement Co. Ltd	1,153
Nittetsu Cement Co. Ltd	1,229
Sumitomo Cement Co. Ltd	7,475
Total	14,127
Central Group:	
Hitachi Cement Co. Ltd	974
Mitsui Mining Co. Ltd	1,815
Onoda Cement Co. Ltd	8,121
Shin Nittetsu Cement Co. Ltd	1,433
Tosoh Corp	2,119
Total	14,462
Dainippon Group:	
Daiichi Cement Co. Ltd	971
Myojo Cement Co. Ltd	1,392
Nihon Cement Co. Ltd	8,439
Osaka Cement Co. Ltd	3,723
Total	14,525
Fuji Group:	
Mitsubishi Mining and Cement Co. Ltd	7,838
Tokuyama Soda Co. Ltd	3,652
Total	11,490
Union Group:	
Chichibu Cement Co. Ltd	5,015
Ryukyu Cement Co. Ltd	474
Tsuruga Cement Co. Ltd	1,226
Ube Industries Ltd	7,525
Total	14,240
Tohoku Kaihatsu Co. Ltd	1,572
Grand total	70,416

Source: Industrial Minerals (London). No. 242, Nov. 1987, p. 37.

Fertilizer Materials.—The nitrogen fertilizer industry continued to suffer from lower domestic demand and increased imports. In fiscal year 1987, the industry reduced further its annual capacity of ammonia and urea from 2,303,000 tons to 2,249,600 tons and from 1,460,000 tons to 1,252,500 tons, respectively. According to the Japan Urea and Ammonium Sulfate Industry Association (JUASIA), in fiscal year 1987, the capacity utilization for ammonia and urea was 83% and 58%, respectively.

Production of ammonium sulfate declined slightly because of reduced consumption for high-analysis compound fertilizer while production of urea dropped considerably because of low market prices and increased imports. Imports of urea reportedly rose 150% to 247,000 tons and exports fell 44% to 59,000 tons in fiscal year 1987. The principal suppliers of urea were Qatar, 40%; Indonesia and Malaysia, 17% each; and the United States and the U.S.S.R., 8% each. Japan's supply and demand for ammonium sulfate, urea, and ammonium chloride, according to JUASIA, are shown in table 8.

Table 8.—Japan: Supply and demand for ammonium sulfate, urea, and ammonium chloride in fiscal year 1987

(Thousand metric tons)

	Ammonium sulfate	Urea	Ammonium chloride
Stocks, beginning	282	96	31
Production	1,787	721	358
Domstic demand:			
Fertilizer	1,117	208	255
Indutrial use	38	472	46
Exports	676	59	41
Stocks, ending	237	78	48

Source: Japan Chemical Annual, 1987.

In the phosphatic fertilizer industry, production of phosphoric acid declined 7% below 1986 to 455,000 tons because of increased imports of ammonium phosphate due to lower world market prices and further appreciation of the yen. To meet requirements for production of phosphoric acid, superphosphate of lime, fused phosphate, multicalcined phosphate, and other compound fertilizers, Japan imported 2.2 million tons of phosphate rock in 1987. The United States, Morocco, and Jordan remained the dominant suppliers accounting for 56%, 23%, and 14%, respectively.

Fluorspar.—Japan was the world's third largest consumer of fluorspar but lacks indigenous resources. Its fluorspar requirements for iron and steel and the fluorine compounds manufacturing industries were met by imports. Imports of fluorspar declined from 570,656 tons in 1985 to 527,545 tons in 1987 mainly because of reduced consumption of metallurgical-grade fluorspar by the iron and steel industry. Of the imports, 283,970 tons was metallurgical grade and 243,970 tons was acid grade. China supplied 384,970 tons, of which 51% was metallurgical grade and 49% was acid grade. Other major suppliers included Thailand, 63,652 tons of metallurgical-grade, and the Republic of South Africa, 47,299 tons of acid-grade fluorspar.

Limestone.—Japan remained the world's third largest limestone producer. Production of limestone rose slightly owing to stronger demand by the iron and steel and construction industries. The top 10 limestone quarries produced 40% of the total during 1986-87. The production by these quarries for 1986-87 is shown in table 9.

Table 9.—Japan: Limestone production of 10 leading quarries

(Thousand metric tons)

Company and mine location	1986	1987
Todaka Mining Co. Ltd.:		
Todaka-Tsukumi, Oita	9,368	9,762
Ube Industries Ltd.:		
Isa, Yamaguchi	10,389	9,561
Nittetsu Mining Co. Ltd.:		
Torigatayama, Kochi	8,891	8,623
Nittetsu-Tsukumi, Oita	4,607	4,772
Mitsubishi Mining and Cement Co. Ltd.:		
Higashitani, Fukuoka	6,783	7,114
Sumitomo Cement Co. Ltd.:		
Shuho, Yamaguchi	5,837	5,842
Onoda Cement Co. Ltd.:		
Onoda-Tsukumi, Oita	5,649	5,776
Onoda-Nagaiwa, Iwate	4,476	4,788
Sumimetal Mining Co. Ltd.:		
Hachinohe Limestone, Aomori	4,396	4,578
Mitsui Mining Co. Ltd:		
Sekinoyama, Fukuoka	4,435	4,422
Other producers	97,527	100,719
Total	162,358	165,957

Source: Limestone Association of Japan.

According to MITI, Japan consumed 167 million tons of limestone in 1987, of which 47% was for cement, 12% for iron and steel, 6% for lime, 29% for construction aggregate and other construction materials, 1% for soda and glass, and 5% for other.

MINERAL FUELS

Coal.—Japan began implementing its Eighth National Coal Policy in April. Under this new policy, Japan's coal production would be reduced to 10 million tons by 1991.

In May, Mitsui Coal Mining, Japan's largest coal mining company, decided to shut down the Sunagawa Mine in Hokkaido and scale down coal operations at the Miike Mine in Kyushu and the Ashibetsu Mine in Hokkaido. In July, Hokutan Mayachi Coal Mining also decided to close its Mayachi Mine in Hokkaido.

The Sunagawa Mine, capable of producing 1 million tons per year, officially ended coal mining on July 14 after 73 years of operation. According to Mitsui Coal Mining, in addition to having problems with methane gas, the mine was losing $14 for each ton of coal produced in 1986. Mitsui Coal Mining planned to gradually reduce its work force by 12% and cut annual production at the Miike Mine in Kyushu and the Ashibetsu Mine in Hokkaido from 4.5 million to 3.5 million tons and 950,000 to 500,000 tons, respectively, by 1990. Because of financial difficulties, Hokutan Mayachi Coal Mining officially ended its coal operations in October and dismissed all 934 workers. The Mayachi Mine had an annual capacity of 700,000 tons.

As a result of mine closures by Mitsui Coal Mining and Hokutan Mayachi Coal Mining in 1987, domestic coal production by the remaining 9 major coal mines and 15 small- and medium-size mines dropped by 3 million to 13 million tons. Of this total, 62% was from the Hokkaido area and 38% was from the Kyushu area; 12% was coking coal, and 88% was anthracite and other bituminous coal. The average heating value of the Japanese coal was 6,030 kilocalories per kilogram in 1987. The industry's employment at yearend declined to 9,167 from 12,906 in 1986. However, labor productivity increased to 100 tons of coal per month per miner from 96 tons of coal per month per miner in 1986. The working days per miner declined to 288 from 296 in 1986. In 1987, domestic coal production was equivalent to 12.5% of domestic consumption.

To meet domestic demand, Japan imported 90.9 million tons of coal in 1987, of which 63.9 million tons was coking coal, 25.4 million tons was steam coal, and 1.6 million tons was anthracite. Coking coal was imported principally from Australia, 45%; Canada, 24%; the United States, 14%; the U.S.S.R., 8%; the Republic of South Africa, 6%; and China, 3%. Other bituminous coal for power generation was imported mainly from Australia, 71%; the Republic of South Africa, 10%; China and the United States, 9% each. Anthracite was imported principally from the Republic of South Africa, 39%; Australia, 14%; and China, 12%.

According to the Ministry of Finance, the average import c.i.f. price per ton of coking coal in 1987 from Australia was $48; Canada, $65; the United States, $64; the U.S.S.R., $48; the Republic of South Africa, $43; and China, $43. The average import c.i.f. price per ton of bituminous coal for power generation in 1987 from Australia and the Republic of South Africa was $42; China, $38; and the United States, $47.

Despite a stronger demand by the cement, ceramics, and electric power industries, the overall demand for coal dropped 2% below 1986 because of reduced consumption by the coke and iron and steel industries. According to MITI, coal consumption by sector was as shown in table 10.

Table 10.—Japan: Coal consumption, by sector

(Thousand metric tons)

Sector	1986[r]	1987
Manufacturing:		
Cement, ceramics, other:		
Domestic	1,497	897
Imported	10,654	13,168
Coke:		
Domestic	621	217
Imported	4,908	4,652
Iron and steel:		
Domestic	1,964	611
Imported	60,859	58,753
Utilities:		
Electric power:		
Domestic	9,335	9,442
Imported	13,300	13,693
Gas:		
Domestic	281	284
Imported	731	544
Other:		
Domestic	1,643	1,283
Imported	10	49
Total demand	105,800	103,593
Of which:		
Domestic	15,338	12,734
Imported	90,462	90,859

[r]Revised.

Source: Ministry of International Trade and Industry, Japan.

Petroleum and Natural Gas.—Domestic production of crude petroleum averaged 12,200 barrels per day compared with 12,683 barrels per day in 1986, while production of natural gas averaged 210 million cubic feet per day compared with 204 million cubic feet per day in 1986. Domestic production was equivalent to 0.4% and 4.7% of Japan's requirements for crude petroleum and natural gas, respectively, in 1987.

Japan remained the second largest importer of crude petroleum and the largest importer of natural gas in the world. De-

spite the higher yen, imports of crude petroleum declined further by 5% to 1,116 million barrels because of reduced consumption by domestic oil refineries resulting from further production cutbacks in kerosene, naphtha, and type C heavy fuel oil. However, because of increased demand for power generation for heating and cooking, imports of natural gas, in the form of LNG, rose 3% over 1986 and reached another record high of 29.2 million tons.

Because of tension in the Persian Gulf, the share of crude petroleum imports from the Middle East dropped further to 67% from 69% in 1986 while the share from Asia, including China, rose to 26% from 24% in 1986. The United Arab Emirates, Saudi Arabia, Indonesia, and China remained the dominant suppliers to Japan, accounting for 19%, 18%, 14%, and 8% of the imports, respectively. Other important suppliers included Iran and Oman, 7% each; Kuwait, 6%; and Mexico, 5%. Imports of LNG from Indonesia were 15.0 million tons; Malaysia, 5.9 million tons; Brunei, 5.2 million tons; the United Arab Emirates, 2.2 million tons; and the United States, 900,000 tons.

Consumption of crude petroleum by the oil refinery industry dropped 2.7% to 2.9 million barrels per day. The industry also reduced its refining capacity by 4.2% to 4.8 million barrels per day in 1987. The industry's average capacity utilization increased slightly to 61.1% compared with 59.9% in 1986. According to an industry source, the refinery industry was expected to trim capacity by 700,000 barrels per day by 1988. To improve efficiency and upgrade the facilities, more secondary-processing facilities would be built to increase production of lighter refined products.

In June, a report on deregulating and restructuring the Japanese petroleum industry was completed by a private advisory committee called the Petroleum Committee of the Petroleum Council. The report recommended to MITI that restructuring through relaxation of Government regulations on production and marketing activities should increase competition among the oil companies. However, it said domestic refineries should continue to be protected from foreign competition. Only domestic refiners were allowed to import refined products.[17]

Imports of refined petroleum products rose sharply because of cutbacks in domestic production of diesel fuel, kerosene, and naphtha. In 1987, imports of diesel fuel rose 353% to 25.4 million barrels, gasoline rose 27% to 26.4 million barrels, kerosene rose 127% to 37.8 million barrels, and naphtha rose 16% to 126 million barrels. Imports as a percentage of domestic consumption of these products were 14% for diesel fuel, 11% for gasoline, 24% for kerosene, and 73% for naphtha.

The principal suppliers of refined petroleum products, in order of value, include Indonesia and Kuwait for naptha; Singapore for gasoline, kerosene, and naphtha; Saudi Arabia for diesel fuel, kerosene, and naphtha; the United Arab Emirates for kerosene and naphtha; and the United States for gasoline and diesel fuel.

In November, MITI announced that beginning in April 1988 it intended to triple taxes on imported oil to finance the national oil stockpile program. The new taxes would be based on volume rather than on value, which has been the basis in the past. To cope with an unstable oil supply in the world market, Japan planned to double its national oil stockpile from 151 million barrels to 314 million barrels by mid-1990. Japan's crude petroleum stockpile at the yearend totaled 483 million barrels, representing a 143-day supply, 153 million barrels were in the national stockpile and the remainder in private stockpiles. According to MITI, the tax changes were necessary because of the declining volume of crude petroleum imports and increasing value of the yen, both lowering the tax base.

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[1]Economist, Division of International Minerals.
[2]Journal of the Mining and Metallurgical Institute of Japan (Tokyo). V. 104, No. 1201, Mar. 1988, p. 6.
[3]Where appropriate, values have been converted from Japanese yen (Y) to U.S. dollars at the rate of Y144.64=US$1.00 for 1987.
[4]U.S. Embassy, Tokyo. State Dep. Telegram 12827, July 22, 1987.
[5]———. State Dep. Telegram 02843, Feb. 18, 1988.
[6]Sumitomo Corp. (Tokyo). Nonferrous Metals in Japan. No. 79, Mar. 1988, p. 62.
[7]Japan Metal Journal (Tokyo). V. 17, No. 25, June 22, 1987, p. 1; v. 17, No. 36, Sept. 7, 1987, p. 1.
[8]U.S. Embassy, Tokyo. State Dep. Telegram 15093, Aug. 25, 1987.
[9]Mining Magazine (London). V. 157, No. 7, Dec. 1987, p. 521.
[10]Page 5 of work cited in footnote 6.
[11]The Rare Metal News (Tokyo). No. 1407, June 24, 1987, p. 3.
[12]———. No. 1389, Feb. 8, 1987, p. 4.
[13]Mining Journal (London). V. 309, No. 7941, Oct. 30, 1987, p. 346.
[14]Far Eastern Economic Review (Hong Kong). V. 138, No. 52, Dec. 24, 1987, p. 62.
[15]Japan Chemical Week (Tokyo). V. 29, No. 1449, Jan. 1988, p. 10.
[16]Industrial Minerals (London). No. 237, June 1987, p. 11.
[17]U.S. Embassy, Tokyo. State Dep. Telegram 11261, June 26, 1987.

The Mineral Industry of Jordan

By Michael D. Fenton[1]

The Jordan Phosphate Mines Co. (JPMC) was the third largest producer of phosphate rock among the market economy countries after the United States and Morocco, and the seventh largest potash producer. The mineral industry continued to dominate Jordanian industrial development as production and sales of phosphate rock, potash, and fertilizer continued to increase. As production costs declined, the Government expected to achieve an annual export revenue goal of at least $300 million.[2]

The gross domestic product increased by about 3%, more than the 2.3% recorded for 1986 but less than the 5.1% target in the 1986-90 development plan. Mining and quarrying grew by 2.7% in 1986 and was expected by the Government to continue at least at this rate during 1987.

The discovery of the Al-Risha Gasfield in northern Jordan was welcome because Jordan continued to depend on imported crude oil, fuel oil, and liquefied petroleum gas for its energy requirements. The National Resources Authority in the Ministry of Energy and Mineral Resources was waiting for data from 8 to 10 wells to be drilled in 1988 before estimating potential reserves.

Jordan Blending and Packing of Fertilizers Co. Ltd., a subsidiary of JPMC, opened Jordan's first chemical fertilizer processing plant, which was at Muthallath al-Ardhah in the Jordan Valley. The initial annual production target was 5,000 tons for the 24,000-ton-per-year-capacity plant. The plant was to use local supplies of phosphate and potash for the production of bulk-blended fertilizers for the local market and neighboring countries.

PRODUCTION AND TRADE

Measured and indicated recoverable reserves of Jordanian phosphate rock were about 820 million tons, with additional inferred reserves exceeding 125 million tons. Measured and indicated reserves at the Shidiya deposit, which was being developed, totaled 750 million tons, while the El Abiad and El Hassa Mines contained 63 million tons and 7 million tons, respectively. The expected lives of the El Hassa and El Abiad Mines were 13 and 10 years, respectively.

During the last decade, Jordan's annual production of phosphate rock increased from 1.4 million tons in 1975 to 6.25 million tons in 1986. JPMC produced 6.8 million tons of phosphate rock during 1987, an increase of nearly 9% over 1986 production. Production from the El Hassa and El Abiad Mines was 4 million tons and 2.8 million tons, respectively. Although the Ruseifa Mine was closed, shipments were made by truck to Aqaba from an inventory.

Although world market prices for phosphates remained low, JPMC managed to increase exports, which enabled Jordan to be one of the few exporters to increase its market share. Exports of phosphate rock were projected to reach 5.7 million tons, an increase of nearly 10% compared with 1986 exports, and 6.5 million tons in 1988. With the planned development of the Eshidiya deposit, annual sales could reach 9 million tons. Since 1984, exports rose about 40% while the world market declined and prices remained low. Principal customers were Czechoslovakia, India, Indonesia, Japan,

Pakistan, Romania, Taiwan, Turkey, and Yugoslavia. Countertrade and bilateral trade agreements became increasingly important in sales.

Jordanian phosphate rock was a relatively high-cost product by world standards, about $36 per ton, f.o.b. Aqaba Port, because of high stripping ratios, low phosphate recoveries, and high transportation costs. In an effort to keep Jordan competitive in the world market, JPMC was developing the Shidiya deposit because it had a thinner overburden and was closer to the port and chemical complex at Aqaba than the operating mines.

JPMC acquired the Jordan Fertilizer Industries Co. (JFIC) in mid-1986 for $160 million as a move toward long-term diversification. Since then, JPMC was able to cut production costs at the Aqaba diammonium phosphate fertilizer plant by $50 per ton to about $200. JPMC also spent about $20 million to increase capacity at the plant. Production during the first 8 months of 1987 was 382,300 tons, compared with 347,000 tons for the same period in 1986, but substantial losses continued to be a result of depressed product prices. The JFIC plant was part of an integrated fertilizer complex that would use domestic raw materials. The company was also studying ways to expand its phosphoric acid production by joining India and the U.S.S.R. in the operation of new plants using local ore. JFIC was also considering producing dicalcium phosphate to mix with livestock feed.

The Arab Potash Co. (APC) increased its production during 1987 to about 1.2 million tons of KCl, and it continued to gain market share as its exports rose to a record 745,700 tons of K_2O. In 1986, 673,800 tons of K_2O was exported. APC has increased production every year since 1982, but profit has continued to elude it; nearly $14.3 million was lost in 1986. APC expected exports to increase further, and a profit was expected upon completion of planned expansions to 1.4 million tons KCl per year in 1988 and to 2 million tons per year by 1992. Sales to Western Europe remained steady, at about 100,000 tons K_2O per year, since 1985, but demand increased in developing Asia, which accounted for about 67% of APC's exports in 1986, and more than 75% in 1987. India, APC's most important customer, bought only 199,100 tons of K_2O, compared with 209,100 tons in 1986. Purchases by China increased, however, from 103,300 tons of K_2O in 1986 to 183,900 tons in 1987. APC also increased shipments of K_2O in 1987 to Indonesia, 51,200 tons; the Republic of Korea, 47,900 tons; and Malaysia, 30,600 tons.

Annual production capacity at the two plants of Jordan Cement Factories Co. (JCFC), which merged with South Cement Co. in late 1985, was 3.5 million tons. But output was only about 60% to 70% of capacity. Nevertheless, JCFC made a $23.4 million net profit in 1987 and repaid $64 million in foreign debts and $56 million in local debts. Local sales were 1.6 million tons, while Egypt took 750,000 to 1 million tons and Yemen (Sanaa), Saudi Arabia, and Iraq bought smaller quantities.

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

Commodity	1983	1984	1985	1986[p]	1987[e]
Cement, hydraulic metric tons	1,271,332	1,988,424	2,022,952	1,794,679	[2]2,373,078
Clays do.	7,817	26,035	[e]26,000	14,144	14,100
Gypsum do.	41,187	[r]111,524	91,965	70,083	[2]114,560
Iron and steel: Steel, crude do.	148,196	112,502	136,266	[e]136,000	136,000
Lime do.	[3]267,093	[3]224,318	[e] [3]224,000	[e] [3]224,000	224,000
Petroleum:					
Crude thousand 42-gallon barrels	--	--	17,428	16,286	16,300
Refinery products:					
Gasoline do.	2,695	3,161	4,900	4,517	4,500
Jet fuel do.	1,976	1,760	1,474	[e]1,600	1,600
Kerosene do.	1,734	1,138	1,529	1,793	1,800
Distillate fuel oil do.	5,132	5,200	10,806	4,602	4,600
Residual fuel oil do.	5,300	5,900	4,720	4,543	4,500
Liquefied petroleum gas do.	875	900	930	1,012	1,000
Other do.	911	865	890	791	800
Total do.	18,623	18,924	25,249	[e]18,858	18,800

See footnotes at end of table.

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

Commodity	1983	1984	1985	1986[p]	1987[e]
Phosphate:					
Mine output thousand metric tons	4,748	[r]6,263	6,067	6,250	[2]6,800
P_2O_5 content[e] do	1,544	2,069	2,011	2,063	[2]2,260
Phosphatic fertilizer metric tons	365,122	568,968	500,650	550,880	[2]565,066
Potash:					
Crude salts do	280,000	486,868	908,560	1,103,716	[2]1,200,000
K_2O equivalent do	170,000	[e]297,000	550,000	660,000	720,000
Salt thousand metric tons	34	22	32	[e]32	18
Stone:					
Limestone[e] metric tons	7,000	7,000	7,000	7,000	[2]13,484
Marble do	102	4,625	4,600	[e]4,600	4,600

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through Aug. 1, 1988.
[2]Reported figure.
[3]Includes aggregates of unspecified type.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986
METALS			
Aluminum: Metal including alloys:			
Scrap	3,245	3,076	Japan 1,539; Netherlands 1,180; India 290.
Semimanufactures	--	16	Turkey 6; Saudi Arabia 5; Iraq 4.
Copper: Metal including alloys:			
Scrap	[r]1,204	603	India 224; Japan 133; Netherlands 100.
Semimanufactures	--	1	All to Saudi Arabia.
Gold: Metal including alloys, unwrought and partly wrought troy ounces	30,190	NA	
Iron and steel: Metal:			
Scrap	9,723	1,872	Japan 1,600; Syria 170.
Steel, primary forms	--	1	All to United Arab Emirates.
Semimanufactures:			
Bars, rods, angles, shapes, sections	630	160	Syria 103; Italy 30; Saudi Arabia 14.
Universals, plates, sheets	95	332	Saudi Arabia 225; Iraq 81.
Hoop and strip	--	3	All to Saudi Arabia.
Wire	32	19	All to Iraq.
Tubes, pipes, fittings value, thousands	$242	$810	Romania $515; Yugoslavia $151; Bulgaria $54.
Lead: Metal including alloys:			
Unwrought	275	--	
Semimanufactures	30	77	Saudi Arabia 50; Kuwait 27.
Titanium: Oxides	--	19	All to Saudi Arabia.
Zinc: Metal including alloys:			
Scrap	120	387	West Germany 150; India 115; Saudi Arabia 65.
Semimanufactures	--	4	All to Iraq.
Other: Ores and concentrates	5	218	All to West Germany.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.: Grinding and polishing wheels and stones	9	1	All to Saudi Arabia.
Cement	387,906	182,033	Saudi Arabia 136,787; Egypt 25,212; Syria 20,034.
Clays, crude	--	80	All to United Arab Emirates.
Fertilizer materials:			
Crude, n.e.s	844,773	1,205,056	India 365,790; China 188,302; Brazil 166,980.
Manufactured:			
Ammonia	6	--	
Nitrogenous	375,452	417,293	India 176,390; Italy 80,379; Saudi Arabia 37,482.
Phosphatic	776	982	United Arab Emirates 815; Saudi Arabia 141.
Unspecified and mixed	--	120	All to United Arab Emirates.
Lime	10,679	2,775	All to Saudi Arabia.
Phosphates, crude thousand tons	5,079	5,198	India 960; Romania 589; Yugoslavia 570.
Potassium salts, crude	844,773	NA	
Salt and brine	222	187	Qatar 94; Kuwait 60; Saudi Arabia 29.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986
INDUSTRIAL MINERALS —Continued			
Sodium compounds, n.e.s.: Sulfate, manufactured	422	859	Syria 579; Iraq 269.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	10,296	4,718	Lebanon 2,260; Egypt 1,019; Iraq 793.
Worked	62,538	103,615	Kuwait 90,813; United Arab Emirates 7,371.
Gravel and crushed rock	1,651	6,837	Lebanon 3,337; Kuwait 3,228.
Quartz and quartzite	1,444	1,472	Kuwait 1,432; Saudi Arabia 40.
Sand other than metal-bearing	10,053	15,713	Kuwait 12,095; Saudi Arabia 3,044.
Sulfur: Sulfuric acid	81	--	
Talc, steatite, soapstone, pyrophyllite	7,310	10,993	Saudi Arabia 8,492; Kuwait 2,466.
MINERAL FUELS AND RELATED MATERIALS			
Coke and semicoke	42	--	
Petroleum refinery products:			
Liquefied petroleum gas 42-gallon barrels	--	1,334	All to Iraq.
Lubricants do.	162	28	All to Syria.

[r]Revised. NA Not available.

[1]Table prepared by Virginia A. Woodson. No exports of mineral commodities were reported to the United States in 1986.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	4,536	473	(2)	France 455; United Kingdom 18.
Metal including alloys:				
Scrap	19	1,022	--	Egypt 496; Saudi Arabia 496.
Unwrought	5,330	4,536	--	Egypt 2,471; Bahrain 1,494.
Semimanufactures	7,653	3,182	21	France 520; Egypt 514; Italy 459.
Chromium: Oxides and hydroxides	50	2	--	All from China.
Copper: Metal including alloys:				
Scrap	310	221	(2)	Iraq 210.
Unwrought	47	51	--	Italy 44; Japan 7.
Semimanufactures	1,112	1,007	13	Beligum-Luxembourg 211; Saudi Arabia 159; Poland 137.
Gold:				
Waste and sweepings value, thousands	$2,266	NA		
Metal including alloys, unwrought and partly wrought troy ounces	439,307	NA		
Iron and steel: Metal:				
Scrap	2,073	1,810	--	Saudi Arabia 1,029; Kuwait 680.
Pig iron, cast iron, related materials	16,087	21,453	--	Australia 21,112.
Ferroalloys:				
Ferrosilicon	60	--		
Unspecified value, thousands	--	$245	$68	Japan $101; Belgium-Luxembourg $69.
Steel, primary forms	164,384	173,929	--	Zambia 81,986; Turkey 70,554; Italy 10,388.
Semimanufactures:				
Bars, rods, angles, shapes, sections	53,384	73,701	--	Brazil 31,130; Saudi Arabia 8,616; Hungary 5,229.
Universals, plates, sheets	40,679	58,867	5	Brazil 16,786; Japan 13,228; Czechoslovakia 6,618.
Hoop and strip	452	422	--	Japan 179; Hungary 130.
Rails and accessories	148	156	--	United Kingdom 49; Italy 38; Belgium-Luxembourg 21.
Wire	9,368	7,819	(2)	Belgium-Luxembourg 2,401; Poland 1,007; Bulgaria 1,140.
Tubes, pipes, fittings value, thousands	$31,595	$29,821	$498	Italy $7,362; West Germany $6,408; Republic of Korea $2,100.
Unspecified	270	--		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Lead:				
Oxides	3	65	--	United Kingdom 60; West Germany 5.
Metal including alloys:				
Unwrought	314	130	--	Saudi Arabia 107; Belgium-Luxembourg 23.
Semimanufactures	9	9	--	West Germany 4; Italy 4.
Magnesium: Metal including alloys, unwrought	--	680	--	All from Czechoslovakia.
Mercury 76-pound flasks	29	87	--	All from Belgium-Luxembourg.
Nickel:				
Matte and speiss value, thousands	--	$1	--	All from West Germany.
Metal including alloys, semimanufactures	5	12	--	Canada 6; West Germany 2; Greece 2.
Platinum-group metals:				
Waste and sweepings value, thousands	$176	NA		
Metal including alloys, unwrought and partly wrought, platinum do	$80	$91	--	Switzerland $70; West Germany $13.
Silver: Metal including alloys, unwrought and partly wrought do	$144	$102	--	United Kingdom $41; Switzerland $32; West Germany $12.
Tin: Metal including alloys:				
Unwrought	13	4	--	All from Netherlands.
Semimanufactures	9	15	(2)	United Kingdom 11; Netherlands 4.
Titanium: Oxides	1,921	808	60	United Kingdom 277; West Germany 202; Belgium-Luxembourg 141.
Zinc:				
Oxides	62	9	--	Belgium-Luxembourg 5; France 3.
Metal including alloys:				
Scrap	41	--		
Unwrought	603	1,128	--	Poland 699; Japan 239; Australia 100.
Semimanufactures	121	53	--	Japan 39; West Germany 10.
Other:				
Ores and concentrates	5	3	3	
Oxides and hydroxides	1	55	--	France 54.
Ashes and residues	--	3	--	Italy 1; Japan 1.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	1,233	956	--	United Kingdom 593; Greece 279.
Artificial: Corundum	35	22	--	Italy 20; West Germany 2.
Grinding and polishing wheels and stones	384	230	(2)	Italy 141; West Germany 65.
Barite and witherite	55	301	--	Italy 281; Spain 20.
Boron materials:				
Crude natural borates	--	105	105	
Oxides and acids	--	34	--	All from Lebanon.
Cement	36,637	2,785	--	Greece 1,500; Saudi Arabia 1,214.
Chalk	1,308	619	3	Greece 200; France 199.
Clays, crude:				
Kaolin	511	NA		
Unspecified	1,065	6,187	7	Turkey 3,412; United Kingdom 1,416; West Germany 505.
Diamond:				
Gem, not set or strung value, thousands	$107	$55	--	India $32; Belgium-Luxembourg $23.
Industrial stones do	$338	$282	--	Belgium-Luxembourg $251; West Germany $31.
Diatomite and other infusorial earth	--	24	--	All from Italy.
Feldspar, fluorspar, related materials	640	928	--	Turkey 643; Belgium-Luxembourg 200.
Fertilizer materials:				
Crude, n.e.s	165	32	--	All from West Germany.
Manufactured:				
Ammonia	56,458	77,134	--	Bahrain 52,993; Kuwait 15,060.
Nitrogenous value, thousands	$4,198	$8,664	--	U.S.S.R. $3,718; United Arab Emirates $1,430; Romania $1,233.
Phosphatic	5,784	8,410	--	Iraq 7,184; Lebanon 610.
Potassic value, thousands	$170	$2	--	All from Greece.
Unspecified and mixed	8,101	8,025	145	Netherlands 4,304; Kuwait 804; West Germany 754.
Graphite, natural value, thousands	$42	$2	--	All from France.
Gypsum and plaster	2,015	1,259	9	Lebanon 609; Iraq 571.
Lime	1,304	1,308	--	Lebanon 1,171; France 102.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Magnesite, crude	26	467	--	Italy 449; Greece 18.
Mica:				
Crude including splittings and waste	39	33	--	All from Norway.
Worked including agglomerated splittings				
value, thousands	--	$2	--	All from India.
Phosphates, crude	76	400	--	All from Turkey.
Pigments, mineral:				
Natural, crude	47	--		
Iron oxides and hydroxides, processed	88	54	--	West Germany 26; Spain 25.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$144	$76	--	Belgium-Luxembourg $66; Thailand $6.
Synthetic do	$56	$385	--	United Arab Emirates $278; Thailand $60.
Pyrite, unroasted	49	2,620	--	Poland 2,566.
Salt and brine	1,442	621	--	Saudi Arabia 216; Belgium-Luxembourg 182; West Germany 75.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	667	6,048	--	Turkey 3,580; United Kingdom 2,049.
Sulfate, manufactured	3,217	6,736	50	United Kingdom 2,346; Turkey 1,503; Belgium-Luxembourg 1,044.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	10,092	9,245	--	Italy 6,544; U.S.S.R. 776; Saudi Arabia 663.
Worked	1,351	564	--	Italy 475; Saudi Arabia 46.
Dolomite, chiefly refractory-grade	145	41	--	All from Norway.
Gravel and crushed rock	2,993	2,715	--	Italy 2,472; Saudi Arabia 115.
Sand other than metal-bearing	371	863	88	Finland 450; Syria 299.
Sulfur:				
Elemental:				
Crude including native and byproduct	169,300	127,528	--	Iraq 126,768; Saudi Arabia 737.
Colloidal, precipitated, sublimed	15,682	35,638	--	Poland 25,710; Saudi Arabia 9,928.
Sulfuric acid	546	487	--	Iraq 445; Belgium-Luxembourg 42.
Talc, steatite, soapstone, pyrophyllite	329	399	--	China 265; Republic of Korea 50; Norway 49.
Other: Crude	94	336	--	Ireland 96; Finland 91; Turkey 49.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	--	33	--	Cyprus 17; United Kingdom 16.
Carbon black	64	5	3	West Germany 1.
Coal:				
Anthracite and bituminous	245	212	--	France 96; West Germany 90.
Briquets of anthracite and bituminous coal value, thousands	$60	$1	--	All from Belgium-Luxembourg.
Coke and semicoke	574	737	13	France 209; Japan 150; Lebanon 133.
Peat including briquets and litter	1,446	408	--	West Germany 155; Sweden 105; Austria 69.
Petroleum:				
Crude[3] thousand 42-gallon barrels	16,304	16,434	--	Saudi Arabia 8,386; Iraq 8,047.
Refinery products:				
Liquefied petroleum gas do	--	67	--	All from Iraq.
Gasoline do	(2)	--		
Mineral jelly and wax do	1	2	--	Mainly from China.
Kerosene and jet fuel value, thousands	$1,012	$807	$475	Saudi Arabia $190; Hungary $70.
Distillate fuel oil thousand 42-gallon barrels	2,944	305	--	All from Iraq.
Lubricants do	132	169	8	France 75; Belgium-Luxembourg 31; Hungary 10.
Nonlubricating oils do	4	--		
Residual fuel oil do	2,628	3,707	(2)	Iraq 3,477; Kuwait 230.
Bitumen and other residues do	--	(2)	--	All from Netherlands.
Bituminous mixtures do	2	2	(2)	Mainly from United Kingdom.

NA Not available.
[1]Table prepared by Virginia A. Woodson.
[2]Less than 1/2 unit.
[3]May include shale oils.

COMMODITY REVIEW

METALS

Jordanian Arab Engineering Industries Co. received 20 offers to build the iron foundry at Yarmouk and invited five companies to discuss the project in early December. A contract was to be awarded by March 1988, and the cost of the project was estimated to be $57.5 million. Initial annual capacity in 1988 of pipe fittings and general engineering castings was expected to be 10,000 tons, rising to 17,000 tons by yearend.

INDUSTRIAL MINERALS

Fertilizer Materials.—*Phosphate Rock.*—JPMC sought financing during the year for the $75 million first phase of the Shidiya mining project, 60 kilometers from Ma'an. The company secured the promise of a $31 million loan from the International Bank for Reconstruction and Development (World Bank) and planned to offer 10 million shares on the Amman Financial Market to raise an additional $58 million in cash. Mining of the 750 million tons of recoverable reserves of phosphate rock would begin by late 1988 at a rate of 800,000 tons per year. Production would increase during the second phase of development (early 1989) when two draglines are working. Several grades of phosphate rock would be mined, ranging from 37% to 83% tricalcium phosphate (TCP), but at first only the best, 83% TCP, would be processed by inexpensive dry screening for sale. Later, stockpiled lower grade phosphate, 37% to 43% TCP, would be upgraded by washing or flotation. Full production of 3 million tons per year would be reached by 1990. The $200 million mine would eventually replace the El Abiad and El Hassa Mines, which had a combined annual capacity of 6.7 million tons, with productive lives of 10 and 13 years, respectively.

JPMC also completed technical feasibility studies on two joint-venture projects, one with India and the other with the U.S.S.R., for phosphoric acid plants in Aqaba. A possible startup date would be in the early 1990's.

JPMC agreed to purchase a $13 million, 30.6-cubic-meter walking dragline for the El Hassa Mine from Ransomes & Rapier Ltd. of the United Kingdom. This replacement of conventional equipment was expected to reduce production costs. Commissioning was scheduled for October 1988.

Potash.—The APC chose the Finnish company, YIT, to expand the potash refinery at Ghor-al-Safi. The $11 million project was to include supplying materials and designing and constructing equipment. Funds were to be provided by the Islamic Development Bank and the World Bank.

APC was granted $1.5 million from the U.S. Agency for International Development to build a cold-crystallization pilot plant to test a less energy intensive method of potash beneficiation. The plan was to increase annual production of potash to about 2 million tons at a cost of $75 to $100 million.

APC prequalified 21 foreign companies for a $12 million contract at its Dead Sea potash plant. Required work included dredging 260,000 cubic meters of soft mud to enlarge and deepen the existing brine intake channel to a maximum depth of 11 meters, dredging 50,000 cubic meters of rock salt reefs in the solar evaporation pan at depths varying from a few centimeters to 3 meters, and modification or replacement of intake pumps at the intake site. This work was required because the level of the Dead Sea had been falling at a rate of about 85 centimeters annually over a 5-year period.

A new, large industrial complex of 12 plants was in the planning stage. It would diversify the production of APC and further exploit the Dead Sea's mineral resources. The $1.5 billion project would be supervised by Jordanian Industrial Consortium Engineering Co., which consists of the Royal Scientific Society, Pension Fund, Social Security Corp., JPMC, and APC. The complex would exploit the 20-million-cubic-meter oil sand resource as a cheap energy source, and process now-wasted potash byproducts into several industrial products.

Salt.—The Azraq salt cooperative opened its $1.5 million factory in early 1987 and immediately faced marketing problems. The capacity of the 50,000-ton-per-year plant was three times local demand, and local salt millers who processed unpurified salt from APC undercut Azraq's prices.

MINERAL FUELS

Natural Gas.—Jordan's Natural Resources Authority (NRA) announced a major gas discovery by its wildcat well, Risha-3, drilled near the Iraqi border. A series of appraisal and delineation wells were to be drilled by Westburne International Drilling

Co. of Canada.

Petroleum.—The NRA and Petro Canada International Assistance Cooperation Co. signed a 2-year agreement under which Canada would provide $19.1 million in technical and geological research aid for the development of Jordan's oil and gas potentials.

The Jordanian Government approved of a production-sharing concession agreement signed by the Ministry of Energy and Mineral Resources and Petrofina S.A. of Belgium. Over a 7-year period, the company would spend $21 million on seismic surveys and three exploration wells in a 11,500-square-kilometer area on the Al-Bazil basalt plateau area north of Azrak. This concession was adjacent to areas currently being worked by Jordan Hunt Oil Co. and Amoco Jordan Petroleum. If oil were to be found, a 25-year production-sharing agreement would come into effect, under which Petrofina would initially get 25% of the oil, decreasing to 10% at the end of the period, when all fixed assets would become Jordanian property.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Jordanian dinars (JD) to U.S. dollars at the rate of JD0.35=US$1.00.

The Mineral Industry of the Republic of Korea

By Chin S. Kuo[1]

The Republic of Korea is a newly industrializing country that is poor in major mineral commodities and consequently has been required to import the majority of the raw materials that its industries use. Of major importance among those imports have been coal, oil, and natural gas, which are primarily used by the heavy and chemical industries.

From the end of July through mid-September the Republic of Korea experienced significant labor disputes. Despite this unrest economic performance in 1987 matched that of 1986, and the country registered a real gross national product (GNP) growth of 12.2% to $108 million.[2] The economic growth in manufacturing (19.9%) and exports (35.7%) was the major factor in the increase. The mineral industry contributed 1.5% of the GNP as compared with 1.4% in 1986. Per capita GNP rose to $2,813 compared with $2,296 in 1986, although this dollar figure actually reflected the appreciation in the exchange value of the won.

To secure more sources of raw materials, the Republic of Korea increased its investment in foreign countries, from $172 million in 1986 to $397 million in 1987. In the mining sector alone, overseas investment rose from $74 million in 1986 to $202 million in 1987. The Government planned to support future overseas investment in development projects, primarily for coal and oil. The Korean Electric Power Corp. and Diamond Alaska Coal Co. of the United States jointly developed a steam coal mine 50 miles west of Anchorage, Alaska to supply the Republic of Korea 1 million tons of coal per year. Pohang Iron & Steel Co. Ltd. (Posco) had a number of overseas joint ventures such as the Tanoma coal mine in Pennsylvania, a 20% stake each in two coal mines in Australia and Canada, and a 50-50 joint venture with USX Corp. of the United States to modernize a USX steel facility in Pittsburg, California. Daewoo Corp. planned to invest $35 million to develop an anthracite mine in Swaziland, and Yukong Ltd. joined White Industries Co. of Australia to develop an Australian anthracite mine. Samsung Co. and Yukong Ltd. signed a contract to form an international consortium with companies in Malaysia, Taiwan, and the United States to undertake oil exploration and production in the Sarawak District of Malaysia. Yukong also planned to participate in an oil development project in Ecuador with Tenneco Oil Co., CSX Corp., and Diamond Shamrock, all of the United States, and with Maersk Olie og Gas A/S of Denmark. Lucky Goldstar International Corp. joined Chevron Corp. of the United States to explore and develop oilfields in California, Oklahoma, Texas, and the Gulf of Mexico. Lucky Goldstar also planned to expand exploration in Southeast Asia after the successful development of the Udang Oilfield in Indonesia in which it participated.

PRODUCTION

Mineral output value was $1.7 billion in 1987. Anthracite coal contributed 64%, while industrial minerals accounted for 22%. The fastest growing mineral industry in the Republic of Korea in 1987 was iron and steel, which also accounted for the largest production volume in the metals sector. Crude steel production reached 16.8 million tons. Among the industrial minerals produced, limestone and cement were most significant, because construction projects for the 1988 Olympic games were in full swing. The country's production of anthracite coal did not meet domestic demand; both anthracite and bituminous coal were imported.

Table 1.—Republic of Korea: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS					
Aluminum, primary	12,629	18,252	17,695	18,643	21,654
Arsenic, mine output, white arsenic equivalent	560	--	--	--	--
Bismuth metal	100	126	135	--	145
Cadmium, smelter	320	230	--	--	--
Copper:					
Mine output, Cu content	389	279	309	220	178
Metal:					
Smelter	124,000	100,200	106,900	165,024	157,923
Refined, primary	123,289	129,078	140,144	157,846	156,311
Gold metal troy ounces	72,083	79,156	77,258	149,436	244,345
Iron and steel:					
Iron ore and concentrate:					
Gross weight thousand tons	655	625	542	528	470
Fe content do	367	350	304	296	263
Metal:					
Pig iron do	8,024	8,763	8,833	9,017	11,057
Ferroalloys:					
Ferromanganese	52,896	58,600	61,396	53,721	58,044
Ferrosilicon	32,489	35,300	34,840	30,939	12,646
Other	43,824	50,215	54,879	66,499	90,382
Total	129,209	144,115	151,115	151,159	161,072
Steel, crude thousand tons	11,916	13,034	13,539	14,554	16,782
Lead:					
Mine output, Pb content	12,226	10,837	9,699	11,864	13,998
Metal, smelter	[r]17,753	[r]20,304	22,394	22,890	[e]29,500
Manganese ore and concentrate:					
Gross weight	--	74	--	177	91
Mg content	--	30	--	71	36
Molybdenum, mine output, Mo content	142	158	333	315	325
Silver metal thousand troy ounces	3,366	3,759	3,990	5,034	6,721
Tin, mine output, Sn content	--	19	21	1	3
Tungsten, mine output, W content	2,480	2,702	2,579	2,455	2,375
Zinc:					
Mine output, Zn content	55,980	49,232	45,746	37,282	23,530
Metal, primary	107,860	108,460	111,653	127,439	186,078
INDUSTRIAL MINERALS					
Asbestos	12,506	8,062	4,703	2,983	2,518
Barite	552	2,729	2,785	3,768	2,942
Cement, hydraulic thousand tons	21,282	20,413	20,424	23,403	25,662
Clays: Kaolin	684,447	721,220	658,282	846,742	630,945
Diatomaceous earth	55,968	48,496	53,613	54,841	64,783
Feldspar	109,896	127,057	145,414	130,895	180,269
Fluorspar, metallurgical-grade	6,361	4,672	705	243	63
Graphite:					
Crystalline	695	2,305	1,602	641	838
Amorphous	32,571	56,258	69,877	96,577	106,507
Total	33,266	58,563	71,479	97,218	107,345
Kyanite and related materials: Andalusite	289	209	42	33	85
Mica: All grades	14,402	24,436	20,044	41,997	31,938
Nitrogen: N content of ammonia	430,169	464,194	441,983	426,778	474,891
Salt	481,000	518,000	643,000	729,000	664,000
Sodium carbonate, manufactured	230,600	247,927	250,890	264,213	[e]288,500
Stone, sand and gravel:					
Limestone thousand tons	32,992	33,456	35,164	38,117	41,675
Quartzite do	842	868	872	885	1,235
Sand including glass sand do	1,223	858	1,096	1,233	1,350

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
INDUSTRIAL MINERALS —Continued					
Sulfur: S content of pyrites	127	--	--	--	--
Talc and related materials:					
Pyrophyllite	460,922	656,442	738,304	587,049	690,819
Talc	171,214	192,208	194,174	210,631	161,052
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	75,424	82,369	91,019	120,534	146,000
Coal: Anthracite thousand tons	19,861	21,370	24,543	24,253	24,273
Coke do	4,682	5,199	[e]5,200	[e]5,100	[e]5,100
Fuel briquets: Anthracite briquets	18,932	21,316	19,453	20,595	23,587
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	4,902	5,519	9,729	9,821	[e]10,000
Jet fuel do	9,074	10,469	10,000	9,662	[e]9,500
Kerosene do	9,199	9,109	10,452	9,559	[e]9,400
Distillate fuel oil do	48,560	54,156	54,783	58,859	[e]58,200
Residual fuel oil do	87,140	84,907	75,566	75,937	[e]73,400
Lubricants do	1,733	1,962	3,807	7,317	[e]7,100
Other do	30,860	43,288	19,031	13,576	[e]15,000
Refinery fuel and losses[e] do	6,700	6,400	4,036	4,000	[e]4,000
Total do	198,168	215,810	187,404	188,731	[e]186,600

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Includes data available through Aug. 3, 1988.

TRADE

The Republic of Korea's exports were $47.1 billion in 1987, an increase of 35.7% over that of 1986, of which mineral exports accounted for $1.0 billion. On the other hand, imports increased 29.7% to $38.5 billion, including mineral and crude oil imports of $7.1 billion. The value of the Republic of Korea's exports of steel reached $2.8 billion in 1987. Steel exports to Japan had a value of $900 million in 1987; Japan replaced the United States as the Republic of Korea's largest steel customer. This change was due to the aging of Japanese steel plants and the rise of the yen's value against the U.S. dollar. Under an orderly marketing agreement with the United States, the Republic of Korea limited the amount of specialty steel exports, including stainless steel bar, stainless steel wire rod, and alloyed tool steel.

The Republic of Korea was a leading importer of ferrous scrap from the United States, a total of 2.9 million tons in 1987. Imports of steel plate also rose to 888,000 tons, primarily from Japan. The Republic of Korea proposed to increase trade with Taiwan for a number of steel products, so that both countries could reduce by 5% their steel imports from Japan.

Table 2.—Republic of Korea: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	50	91	--	Bangladesh 52; Thailand 11.
Metal including alloys, all forms	25,347	19,150	750	Hong Kong 7,291; Japan 2,182; Bangladesh 1,618.
Antimony:				
Oxides	--	53	--	Taiwan 43.
Metal including alloys, all forms	--	280	261	Hong Kong 18.
Arsenic: Oxides and acids	307	41	--	Japan 17; Malaysia 12.
Bismuth: Metal including alloys, all forms	139	178	20	Netherlands 98; Japan 39.
Cadmium:				
Oxides and hydroxides	179	465	13	Taiwan 396; Japan 39.
Metal including alloys, all forms	145	104	15	Japan 56; Netherlands 17.
Cobalt: Oxides and hydroxides	30	21	--	Japan 19.

See footnote at end of table.

Table 2.—Republic of Korea: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Columbium and tantalum: Metal including alloys, all forms, tantalum kilograms	14	--		
Copper: Metal including alloys:				
Scrap	751	1,180	--	Singapore 600; Japan 580.
Unwrought	4,035	5,756	10	Taiwan 3,990; Japan 1,551.
Semimanufactures	33,033	40,334	3,804	Hong Kong 8,907; India 7,680; Taiwan 7,335.
Gold: Metal including alloys, unwrought and partly wrought troy ounces	476	48,270	13,798	Japan 20,270; Hong Kong 7,424.
Iron and steel: Metal:				
Scrap	74,006	71,525	142	Thailand 43,000; Japan 15,925.
Pig iron, cast iron, related materials	82	1,515	5	Indonesia 1,000; Japan 388.
Ferroalloys:				
Ferromanganese	30	5	--	All to Italy.
Ferrosilicon	36	20	--	All to Japan.
Unspecified	1,021	3,031	4	Japan 3,027.
Steel, primary forms thousand tons	1,605	1,354	232	Japan 714.
Semimanufactures do	4,181	4,627	967	Japan 854; Saudi Arabia 577.
Lead:				
Ore and concentrate	1,700	--		
Metal including alloys, all forms	458	9,264	11	Japan 9,035.
Magnesium: Metal including alloys:				
Scrap	27	20	--	All to Japan.
Unwrought	19	28	--	Do.
Manganese: Ore and concentrate, battery-grade	250	70	--	All to Taiwan.
Molybdenum: Ore and concentrate	230	308	--	Belgium-Luxembourg 236; West Germany 72.
Nickel: Metal including alloys:				
Scrap	108	225	106	Japan 117.
Semimanufactures	5	6	2	Hong Kong 2.
Platinum-group metals:				
Waste and sweepings value, thousands	$140	$819	$127	Japan $312; United Kingdom $214.
Metals including alloys, unwrought and partly wrought troy ounces	1,124	1,554	867	Japan 687.
Silver: Metal including alloys, unwrought and partly wrought thousand troy ounces	1,356	1,004	193	Japan 764.
Tin: Metal including alloys:				
Scrap	136	32	--	All to Japan.
Unwrought	13	116	1	Japan 103.
Titanium: Oxides	2,148	1,496	--	Japan 1,466.
Tungsten:				
Ore and concentrate	747	514	--	Japan 329; West Germany 94.
Oxides and hydroxides	--	15	--	All to Austria.
Metal including alloys, all forms	364	261	18	Japan 112; West Germany 62.
Zinc:				
Oxides	3,650	4,445	--	Japan 3,437.
Ash and residue containing zinc	1,754	9,452	--	Australia 8,628.
Metal including alloys, all forms	1,216	2,160	1,006	Taiwan 754.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Natural: Corundum, emery, pumice, etc	26	23	--	Singapore 20.
Cement thousand tons	2,986	4,401	504	Saudi Arabia 1,011; Hong Kong 811; Japan 777.
Chalk	1	11	11	
Clays, crude	70,418	63,158	--	Japan 58,283.
Diatomite and other infusorial earths	200	167	--	Taiwan 117.
Feldspar, fluorspar, related materials	22,746	16,759	--	All to Taiwan.
Fertilizer materials: Manufactured:				
Nitrogenous	194,088	143,772	--	Philippines 83,250; Fiji 27,450; Thailand 14,267.
Phosphatic	20,060	35,713	--	Japan 30,920.
Potassic	27,461	36,677	--	Philippines 14,900; Japan 7,830.
Unspecified and mixed	1,049,240	927,415	--	Thailand 360,209; Japan 82,514; Philippines 46,146.
Graphite, natural	48,353	30,969	--	Japan 22,081; Taiwan 6,320.
Gypsum and plaster	19,034	69	--	All to Taiwan.
Lime	--	7,432	--	Indonesia 5,501; Ethiopia 1,000.
Magnesium compounds: Magnesite, crude	--	16	--	All to Philippines.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$4,277	$10,039	$4,162	Japan $4,854; Hong Kong $879.
Synthetic do	$11,532	$15,920	$10,903	Spain $1,435; West Germany $877.
Salt and brine	6,412	11,689	7,578	Japan 3,991.
Sodium compounds, n.e.s.: Carbonate, manufactured	--	715	--	Japan 500; Nigeria 215.

See footnotes at end of table.

Table 2.—Republic of Korea: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone, all forms	243,444	298,702	--	Japan 286,611.
Dolomite, chiefly refractory-grade	89,100	116,563	--	Japan 116,545.
Gravel and crushed rock	909	412	--	All to Japan.
Quartz and quartzite	17,764	6,654	--	Japan 6,600.
Sand other than metal-bearing	5,005	2,012	--	All to Japan.
Sulfur: Elemental: Crude including native and byproduct	2,953	3,399	--	Indonesia 1,308; Bangladesh 1,000; Sri Lanka 489.
Talc, steatite, soapstone, pyrophyllite	37,987	42,486	1,624	Japan 14,200; Thailand 10,470; Taiwan 5,835.
Other:				
Crude	251,374	249,130	--	All to Japan.
Slag and dross, not metal-bearing	126,737	124,517	--	Do.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	11,033	15,836	--	Sudan 3,580; Indonesia 3,498; Hong Kong 2,625.
Coke and semicoke	320	2,462	--	Japan 2,242.
Petroleum refinery products:				
Naphtha thousand 42-gallon barrels	5,865	6,775	--	Japan 6,303.
Gasoline:				
Aviation do	2,343	2,588	371	Japan 2,011.
Motor do	2,603	1,082	884	Japan 155.
Kerosene and jet fuel do	3,274	2,900	415	Japan 1,342.
Distillate fuel oil do	4,613	5,069	1	Japan 4,817.
Lubricants do	848	775	8	Taiwan 37; Japan 34; unspecified 643.
Residual fuel oil do	8,709	104,882	78,227	Japan 8,536.

[1]Table prepared by Audrey D. Wilkes.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	9,177	15,571	--	Hong Kong 10,995.
Oxides and hydroxides	77,487	93,127	82	Japan 46,005; Australia 30,490.
Metal including alloys:				
Scrap	5,563	8,799	6,411	Japan 1,026.
Unwrought	200,389	184,512	10,483	Australia 80,549; Canada 25,851.
Semimanufactures	35,345	30,582	1,520	Japan 13,197; Australia 7,798.
Antimony:				
Ore and concentrate	883	4,655	--	Hong Kong 1,557; Thailand 445.
Oxides	337	644	1	Japan 182; West Germany 26.
Metal including alloys, all forms	58	298	--	Japan 142.
Chromium:				
Ore and concentrate	3,875	3,274	7	Philippines 2,940.
Oxides and hydroxides	1,662	2,422	1,105	Japan 993; United Kingdom 218.
Cobalt:				
Oxides and hydroxides	8	30	1	Finland 10; Belgium-Luxembourg 6; Canada 6.
Metal including alloys, all forms	148	444	14	Netherlands 210; Zaire 80; Japan 76.
Copper:				
Ore and concentrate	355,210	389,143	41,793	Papua New Guinea 70,124; Canada 67,654; Chile 57,677.
Matte and speiss including cement copper	33,127	18,897	17,854	Chile 861.
Oxides and hydroxides	602	924	623	West Germany 94; Norway 90; France 81.
Sulfate	32	84	4	Japan 52; France 19.
Ash and residue containing copper	18	--		
Metal including alloys:				
Scrap	32,592	74,949	37,621	Taiwan 19,035; Hong Kong 5,349.
Unwrought	60,275	99,682	17	Japan 30,532; Chile 27,445; Philippines 26,324.
Semimanufactures	11,204	17,355	317	Japan 12,280.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Gold:				
Ore and concentrate	--	4,783	28	Japan 4,721.
Metal including alloys, unwrought and partly wrought troy ounces	371,186	189,524	42,500	Hong Kong 105,510; Japan 30,938.
Indium: Metal including alloys, all forms kilograms	229	243	2	Netherlands 69; Peru 63; Japan 59.
Iron and steel:				
Iron ore and concentrate including roasted pyrite thousand tons	12,418	11,941	--	Australia 4,513; India 2,582; Brazil 2,295.
Metal:				
Scrap do	2,395	3,115	2,653	Japan 138; Australia 132.
Pig iron, cast iron, related materials	121,553	392,146	29	Japan 191,750; Brazil 154,830.
Ferroalloys:				
Ferrochromium	7,529	10,431	--	Philippines 4,339; Zimbabwe 3,983.
Ferromanganese	1,818	1,124	--	Japan 889; Spain 185.
Ferromolybdenum	313	582	54	Netherlands 106; Chile 84; Switzerland 77.
Ferronickel	780	725	--	Colombia 410; Dominica 275.
Ferrosilicomanganese	108	5	--	All from Japan.
Ferrosilicon	9,094	15,834	11	Norway 5,036; Japan 4,438; Taiwan 1,001.
Ferrovanadium	228	262	--	Belgium-Luxembourg 71; Japan 61; Netherlands 48.
Silicon metal	1,585	2,627	19	Portugal 918; Canada 370; Norway 363.
Unspecified	2,879	3,852	65	Japan 2,067; France 930.
Steel, primary forms thousand tons	1,250	1,688	6	Japan 1,069; Brazil 215.
Semimanufactures do	1,641	2,162	79	Japan 1,906.
Lead:				
Oxides	34	16	(2)	West Germany 12.
Metal including alloys:				
Scrap	20,162	39,382	7,273	Australia 15,823; Japan 4,429; Kuwait 3,290.
Unwrought	63,803	55,032	4,034	Australia 14,090; Peru 11,546.
Semimanufactures	138	376	11	Australia 308.
Lithium:				
Oxides and hydroxides	43	287	282	France 2.
Metal including alloys, all forms kilograms	10	176	35	Japan 98.
Magnesium: Metal including alloys, unwrought	651	927	484	Norway 196; France 124.
Manganese:				
Ore and concentrate:				
Battery-grade	4,391	5,302	--	Singapore 3,764; Japan 645.
Metallurgical-grade	271,529	217,529	--	Australia 110,893; India 40,700; Gabon 22,488.
Oxides	1,636	2,408	(2)	Japan 1,685.
Mercury 76-pound flasks	411	568	47	Spain 220; Japan 206.
Molybdenum: Ore and concentrate	115	263	24	Canada 113; Japan 26.
Nickel:				
Oxides and hydroxides	33	36	--	Japan 32.
Metal including alloys:				
Scrap	327	284	110	Canada 174.
Unwrought	3,471	5,839	49	Canada 1,300; Australia 1,108; United Kingdom 867.
Semimanufactures	1,144	1,085	69	Japan 295; Canada 241; Norway 135.
Platinum-group metals: Metals including alloys, unwrought and partly wrought troy ounces	12,789	18,960	3,161	Japan 10,708; West Germany 3,283.
Selenium, elemental	10	11	--	Japan 9.
Silver: Metal including alloys, unwrought and partly wrought troy ounces	473,033	473,676	24,306	Japan 210,169; France 138,312; Singapore 73,947.
Tin:				
Ore and concentrate	2,687	1,532	--	Thailand 499; Burma 424; Singapore 289.
Metal including alloys, all forms	1,674	4,052	110	Malayia 2,393; Indonesia 898.
Titanium:				
Ore and concentrate	39,570	50,095	--	Malaysia 42,778; Australia 7,303.
Oxides	3,260	4,196	78	Japan 2,589; West Germany 1,330.
Metal including alloys, all forms	111	204	5	Japan 175.
Tungsten: Metal including alloys, all forms	34	169	134	Japan 27.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Uranium and/or thorium: Metal including alloys, all forms	108	64	57	Canada 7.
Zinc:				
Ore and concentrate	162,946	179,136	--	Australia 74,842; Peru 32,687; Canada 21,468.
Oxides	245	151	30	Japan 102.
Ash and residue containing zinc	976	1,387	88	Saudi Arabia 1,264.
Metal including alloys:				
Scrap	10,572	13,109	4,006	Japan 6,617.
Unwrought	11,399	117,492	--	Thailand 92,930; Australia 5,300.
Semimanufactures	211	750	2	Japan 391; Peru 350.
Zirconium: Ore and concentrate	5,928	10,844	--	Australia 8,719; Malaysia 774; Japan 411.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	7,654	7,002	526	Japan 5,766; India 605.
Artificial:				
Corundum	18,271	21,923	12	Japan 10,308;; Brazil 3,599.
Silicon carbide	5,559	7,097	18	Japan 2,371; West Germany 1,862; Norway 1,160.
Dust and powder of precious and semi-precious stones including diamond kilograms	268	2,149	1,088	Ireland 865.
Grinding and polishing wheels and stones	1,078	1,129	62	Japan 806.
Asbestos, crude	57,143	68,017	1,420	Canada 28,575.
Barite and witherite	1,113	1,436	18	Thailand 681; United Kingdom 600.
Boron materials:				
Crude natural borates	1,555	1,862	1,049	Japan 305; Netherlands 302.
Oxides and acids	1,683	2,329	1,515	Italy 352; Japan 110.
Bromine	356	228	31	Italy 88.
Cement	5,793	16,634	144	Republic of Korea 8,701; France 4,548.
Chalk	998	2,571	--	All from France.
Clays, crude:				
Bentonite	5,062	5,414	4,417	France 829.
Chamotte and dinas earth	10,909	8,086	827	Hong Kong 4,499.
Kaolin	41,979	53,079	50,477	New Zealand 1,529.
Unspecified	30,794	45,905	10,041	Japan 18,193; Hong Kong 9,570.
Cryolite and chiolite	22	10	--	Denmark 5; Japan 5.
Diamond: Natural: Gem, not set or strung value, thousands	$2,227	$2,173	$297	Belgium-Luxembourg $1,655.
Diatomite and other infusorial earth	--	77	7	Japan 70.
Feldspar, fluorspar, related materials	46,920	29,393	5	Thailand 20,426.
Fertilizer materials: Manufactured:				
Ammonia	418,669	375,636	215,323	Indonesia 70,164; Bahrain 53,846.
Nitrogenous	1,945	987	1	Chile 620; Austria 108.
Potassic	489,060	429,960	4,659	Canada 318,420; Jordan 52,100.
Unspecified and mixed	49,178	783	9	Japan 324; Belgium-Luxembourg 72.
Graphite, natural	1,084	3,180	2	Japan 1,018.
Gypsum and plaster	151,865	227,813	28	Thailand 127,230; Mexico 89,681.
Iodine	13	14	--	Japan 13.
Kyanite and related materials	3,166	3,141	617	Australia 396; Hong Kong 250.
Lime	307	28	--	All from Japan.
Magnesium compounds:				
Magnesite, crude	141	728	--	Japan 228; unspecified 500.
Oxides	38,003	75,369	74	Japan 39,251; Hong Kong 6,298.
Mica:				
Crude including splittings and waste	1,024	988	177	Malaysia 522; India 139.
Worked including agglomerated splittings	252	235	1	Japan 124; New Zealand 62.
Nitrates, crude	4,249	6,680	--	Chile 6,560.
Phosphates, crude thousand tons	1,771	1,608	1,376	Jordan 142.
Phosphorus, elemental	1,864	1,856	534	France 171; Netherlands 155.
Pigments, mineral:				
Natural, crude	148	195	--	Austria 133; Japan 42.
Iron oxides and hydroxides, processed	5,178	7,617	1,872	Japan 4,122; West Germany 784.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Precious and semiprecious stones other than diamond:				
Natural ----- value, thousands--	$3,068	$7,657	$3,615	Brazil $1,597; Hong Kong $987.
Synthetic ----------do----	$6,237	$12,902	$4,944	Japan $3,172; Taiwan $3,141.
Pyrite, unroasted----------	4,616	10	--	All from Japan.
Salt and brine----------	800,109	872,771	106	Australia 662,312; Mexico 106,616.
Sodium compounds, n.e.s.:				
Carbonate, manufactured--------	22,493	36,127	32,825	Japan 3,302.
Sulfate, manufactured ---------	18,544	19,028	4,504	Taiwan 4,491; Japan 3,131; Indonesia 2,456.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked -----	13,257	3,166	17	Japan 993; Portugal 581; Guatemala 536.
Worked----------	24,002	6,453	91	Italy 6,284.
Dolomite, chiefly refractory-grade --	347	459	--	Japan 233; Norway 206.
Gravel and crushed rock --------	1,564	2,215	91	France 668; Japan 284; West Germany 275.
Limestone other than dimension ---	10	12,008	8	Japan 12,000.
Quartz and quartzite----------	587	809	10	Sweden 317; Japan 245.
Sand other than metal-bearing ----	140,550	198,992	140	Australia 180,052; Malaysia 17,500.
Sulfur:				
Elemental:				
Crude including native and by-product----------	592,896	518,369	18	Canada 432,576; Japan 66,714.
Colloidal, precipitated, sublimed-	1,025	1,330	921	Japan 388.
Sulfuric acid----------	49,967	147,353	1,083	Japan 146,270.
Talc, steatite, soapstone, pyrophyllite --	29,742	41,926	3,511	Australia 15,725; Hong Kong 10,016.
Vermiculite----------	23	(3)	(3)	
Other:				
Crude----------	34,663	98,987	279	Japan 81,554; Australia 6,428.
Slag and dross, not metal-bearing ---	33,502	62,733	--	Japan 62,414.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural --------	107	89	80	Japan 9.
Carbon black ----------	4,187	5,800	960	Japan 2,143; Australia 1,512.
Coal:				
Anthracite------ thousand tons--	2,659	4,483	785	Unspecified 3,472.
Bituminous ----------do----	17,131	16,436	2,113	Australia 7,985; Canada 3,160.
Lignite including briquets --------	75,465	54,255	--	Australia 38,755.
Coke and semicoke----------	105,778	126,618	1,261	Japan 85,928; Pakistan 19,976.
Petroleum:				
Crude- thousand 42-gallon barrels--	203,429	212,286	--	Oman 26,731; Malaysia 24,203; Saudi Arabia 23,568.
Refinery products:				
Liquefied petroleum gas -do----	6,494	9,120	(2)	Saudi Arabia 6,173; Indonesia 1,581.
Gasoline ----------do----	297	967	47	Saudi Arabia 262; United Arab Emirates 250.
Naphtha ----------do----	5,343	8,032	--	Saudi Arabia 2,638; Singapore 2,265; United Arab Emirates 1,166.
Mineral jelly and wax --do----	77	95	5	Japan 82.
Kerosene and jet fuel---do----	175	395	50	Italy 263.
Distillate fuel oil -----do----	2,375	3,984	2,569	Saudi Arabia 451; Kuwait 281.
Lubricants ----------do----	330	231	22	Japan 190.
Residual fuel oil------do----	13,922	13,857	2,733	Japan 4,654; Saudi Arabia 2,299; Singapore 2,087.
Petroleum coke ------do----	784	575	513	Japan 44.

[1]Table prepared by Audrey D. Wilkes.
[2]Less than 1/2 unit.
[3]Unreported quantity valued at $2,821.

COMMODITY REVIEW

METALS

Copper.—The Republic of Korea produced little ore from its domestic reserves, which were estimated at 20 million tons of ore with an average grade of 1.0%. Most of its copper concentrate was imported from Canada, Mexico, and the Philippines. Copper metal was refined at Korea Mining & Smelting Co. Ltd.'s two copper refineries, which had a combined capacity of 160,000 tons per year. The country also imported about 36,000 tons of scrap copper from the United States during 1987. Domestic demand for refined copper was 263,000 tons, of which 107,000 tons was imported.

Iron and Steel.—Steel capacity was rated at 17.3 million tons per year in 1987, making the Republic of Korea the 10th largest steel producer in the world. However, it imported most of the raw materials for steelmaking, including 16.2 million tons of iron ore from Australia, Brazil, India, and Peru, and 9.2 million tons of coking coal from Australia, Canada, and the United States. Domestic output of iron ore in 1987 was 569,000 tons, coming mainly from the Yangyang Mine in Kangwon. Although an iron ore deposit was discovered near Chongson, 200 kilometers southeast of Seoul, a new mine at this site will not change the country's heavy dependence on imports of iron ore. A 1-million-ton-per-year capacity mine with estimated reserves of 28 million tons and an iron content of 50% is being planned for commissioning in 1992.

Posco operated at 95% capacity and produced two-thirds of the nation's steel in 1987. Domestic steel production met 75% of domestic demand, which rose 16.3% in 1987 to 21.6 million tons. The increase in demand was due primarily to high-volume automobile and ship production and exports. Major shipyards accounted for 8% of the domestic steel consumption. The domestic steel shortage was met by importing 4.8 million tons of steel of all kinds from Brazil and Japan.

Posco dedicated its second integrated steel mill, built on reclaimed land in Kwangyang Bay on the southwest coast. The cost of the plant was $637 per ton of raw steel capacity. The plant increased Posco's capacity by 2.7 million tons to 11.8 million tons, making it the country's largest and the world's fifth largest steelmaker. Second- and third-stage expansions at Kwangyang Bay of 2.7 million tons per year each were to be completed by October 1988 and November 1991, respectively. The third stage, costing $2.3 billion, will triple the annual capacity at Kwangyang Bay. When the third-stage expansion is completed, Posco will have a capacity of 17.2 million tons per year and will be the world's second largest integrated steelmaker, after Japan's Nippon Steel Corp. At that time the Republic of Korea will be the world's sixth largest steel producer. State-run Posco is currently owned by the Ministry of Finance, 33.4%; Korea Development Bank, 38%; Korea Tungsten Mining Co. Ltd., 2.5%; and four Korean commercial banks, 26.1%. The Government intends to sell 5% of its shares annually to the public beginning in 1988.

Lead and Zinc.—Korea Zinc Co. planned to expand its lead refining capacity from 25,000 to 80,000 tons per year by 1990. A new lead-zinc deposit was discovered by Young Poong Corp. adjacent to its Taebaek lead-zinc mine, 280 kilometers southeast of Seoul. Young Poong plans to develop the deposit during the next 3 to 5 years when the Taebaek Mine ore is exhausted. In 1987, the country produced 46,975 tons of zinc concentrates. The capacity of Korea Zinc's Onsan zinc smelter was doubled to 150,000 tons per year, increasing the country's capacity to 225,000 tons per year. The Sukpo smelter, owned by Korea Zinc's parent, Young Poong, was operated at full capacity of 75,000 tons per year. These two smelters produced 183,840 tons of refined zinc. The Republic of Korea's consumption of zinc increased from that of 1986 to 221,000 tons owing to Posco's expanded production of zinc-coated steel plates.

Nickel.—Although the Republic of Korea does not produce nickel ore, it plans to produce nickel metal for stainless steel manufacturing. Korea Zinc signed a joint-venture agreement with Inco Ltd. of Canada to build a $4 million, 15,000-ton-per-year plant near Ulsan. The plant, expected to be completed by yearend 1988, would use crude nickel oxide or nickel oxide sinter from either Canada or Indonesia. Beginning in 1989 it would supply nickel to Posco's new 250,000-ton-per-year stainless steel plant at Pohang.

Tungsten.—Korea Tungsten Mining Co. Ltd. produced 2,188 tons of tungsten metal from its Shang Dong scheelite mine and plant, a slight decrease from that of 1986 due to low world tungsten prices and the weaker U.S. dollar. The mine has 20 million tons of reserves at 50% WO_3 and a capacity of 2,350 tons per day. The mine and

plant accounted for the majority of tungsten metal output in the nation with the rest coming from several small mines.

INDUSTRIAL MINERALS

Cement.—The Republic of Korea is abundant in limestone, having estimated ore reserves of 41.5 billion tons. In 1987 it produced 41.7 million tons of limestone. Six major cement manufacturing companies, having a combined production capacity of 33 million tons, supplied 24.8 million tons of cement to the domestic market. A cartel created to transport cement was dissolved by the Government in September because transportation systems had improved substantially and the cement producers were engaging in unfair trading practices. The cartel, Nungwon Enterprises, handled 90% of the Republic of Korea's production of cement. Ssangyong Cement Industrial Co. Ltd., one of the cartel companies, was the largest producer, accounting for 42% of the country's cement production.

Exports of cement increased to 4.9 million tons in 1987 compared with 4.4 million tons in 1986. Japan was the fastest growing market for these exports.

Talc.—The nation's annual talc production capacity was 200,000 tons, which represented 82% of demand. A talc deposit was discovered in Kongju, 170 kilometers southwest of Seoul. It contains 10 million tons of proven reserves and has a thickness of 115 meters. State-run Korean Mining Promotion Corp. found the deposit. The deposit will be developed and is expected to produce 200,000 tons of talc annually beginning in 1992.

MINERAL FUELS

Coal.—Domestic consumption of anthracite coal was 27.3 million tons in 1987, 3 million tons more than mine production. Approximately 20% was produced by the Dai Han Coal Corp., a state-owned company, and the remainder was produced by 360 independent, privately owned collieries. The Republic of Korea imported steam coal from Alaska and coking coal from Australia and Canada.

Natural Gas.—Domestic demand for liquefied natural gas (LNG) for household, commercial, and industrial uses has steadily increased to 1.6 million tons in 1987 and is expected to reach 2.0 million tons in 1991 and 5.0 million tons in 1996. At present Indonesia has a 20-year contract to supply 2.0 million tons of LNG annually to the Republic of Korea through the port of Pyongtaek, Konggi Province. The deficiencies in the future could be met by supplies from Australia, Malaysia, Qatar, and the United States. Korea Gas Corp. began constructing a new $350 million, LNG receiving terminal in 1987, which is to be completed in 1991. State-run Korean Petroleum Development Corp. found natural gas in November 1987, 3,200 meters under the seabed and 120 kilometers east of Pusan.

Petroleum.—The country's dependence on imported crude oil valued at $4 billion generally reflected increased consumption of naphtha, light oil, gasoline, and other energy used in the transportation sector. The sources of the oil were Africa, Central and South America, the Middle East, and Southeast Asia. The nation's largest oil refinery, which has a capacity of 380,000 barrels per day, is operated by Honam Oil Refinery Co. Ltd. in the southern port of Yochon. The other large oil refinery, capable of processing 90,000 barrels per day and owned and operated by Ssangyong Oil Refinery Co. Ltd. at Onsan, produced high-quality, high-viscosity lube-base oils. Kukdong Oil Co. Ltd. and British Petroleum Corp. plan to build a $550 million oil refinery with a hydrocracking facility at Sosan, 85 kilometers south of Seoul. The refinery will have a capacity of 60,000 barrels per day and is scheduled to be completed in late 1988.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Korean won (W) to U.S. dollars at the rate of W795.2 = US$1.00 for 1987.

The Mineral Industry of Kuwait

By Michael Fenton[1]

Kuwait was one of the world's smallest but most prosperous nations, in which the oil sector dominated the economy. Kuwaiti oil production was 2% of total world production. Economically recoverable reserves reached nearly 95 billion barrels, third only to Saudi Arabia's and the U.S.S.R.'s. Kuwait's proven natural gas reserves, mostly associated gas, were about 36.4 trillion cubic feet. About 88% of Kuwaiti exports was accounted for by oil; nearly one-half of this was refined products. The nonfuel mineral-producing sector included cement, chlorine, clays, lime, salt, and caustic soda.

The world oil markets continued to be the most important concern of Kuwait, and the threat of the expanding Iran-Iraq war finally became serious enough for the Government to request U.S. naval protection of Kuwaiti tankers in the Persian Gulf. Kuwait continued to diversify its economy beyond that of an oil producer by expanding into overseas refining and marketing. It continued to make overseas investments in real estate, tourist resorts, and industrial ventures. One such investment was its recently acquired 21% share of British Petroleum PLC, which represented about 7% of Kuwait's total overseas investment of $90 billion. Kuwait also increased its interest in Union Explosivos Rio Tinto SA (ERT), Spain's largest chemical company to 24.9%. ERT operates an 80,000-barrel-per-day (bbl/d) refinery at Huelva. Diversification and prudent investment policies based on immense oil wealth appeared to assure prosperity well into the future, provided oil prices remain firm and oil exports pass undisturbed through the Persian Gulf.

PRODUCTION AND TRADE

During most of 1986, Kuwait was a principal advocate of the Organization of Petroleum Exporting Countries (OPEC) price-war strategy of high production that sent oil prices down to $7 per barrel between December 1985 and August 1986. Kuwait then agreed to submit to a new production quota that fluctuated during late 1986, but stabilized at 948,000 bbl/d by 1987. Some members of OPEC cut 1987 oil production to adhere to quotas in an effort to raise and stabilize world oil prices and to secure OPEC's share of the oil market. OPEC production fell 8.3% to about 16.7 million bbl/d during the first half of 1987 from the same period in 1986, and world oil production fell 2.2%. However, OPEC production exceeded its combined quota of 16.6 million bbl/d by almost 4 million bbl/d in September 1987, because of alleged overproduction by several members, including Kuwait.[2] The OPEC price of oil reached $22 briefly in late 1987 because of worries over a possible war-related supply disruption, but it then fluctuated between about $18 and $20 per barrel.

Production of crude oil in Kuwait by the Kuwait Oil Co. (KOC) and Kuwait's share of production in the Kuwait-Saudi Arabia Divided Zone by Wafra Oil Co. and Arabian Oil Co. totaled nearly 1.4 million bbl/d from 362 flowing wells, a decrease of about 7% from that of 1986. Nevertheless, production was well above Kuwait's quota of 948,000 bbl/d for the first half and 996,000 bbl/d for the second half of 1987. Maximum sustain-

able production capacity was 2 million bbl/d, whereas installed capacity was 2.9 million bbl/d. The cost of pumping oil in Kuwait was only about $1 per barrel, compared with $8 to $13 per barrel in the North Sea. Natural gas production declined to an estimated gross 182 billion cubic feet, a decrease parallel to reduced production of associated crude oil.

Rising oil prices from a $7 low to the $18 to $20 range brought about increases in earnings from oil exports and trade and current-account surpluses. The value of oil exports rose 22% during 1987 to an estimated $7.8 billion[3] after falling to $6.4 billion in 1986 from $9.5 billion in 1985, according to the Central Bank of Kuwait. Meanwhile, during 1985-87, the value of imports declined from about $5.9 billion to $4.9 billion. The trade surplus also rose during 1987 to an estimated $3.9 billion after falling from $4.5 billion in 1985 to $1.5 billion in 1986. The gross domestic product increased by about 5% after declining during the previous 2 years, mainly because of the rise in the value of oil exports.

Kuwait Petroleum Corp. (KPC), which oversees all state hydrocarbons production, processing, and transportation activities, had a net profit of $244.3 million for fiscal year 1986 (year ending June 30, 1987). This was greater than the $179.5 million profit for FY 1985. Total revenues for FY 1986 were $10.3 billion.

About 90% of Kuwait petroleum production was sold through nearly 5,000 Q8 gasoline stations in Western Europe owned by KPC. The Q8 brand has captured market shares of 25% in Denmark, 15% in Belgium, 15% in Sweden, 14% Luxembourg, 7% in the Netherlands, 5% in Italy, and 2% in the United Kingdom was planning to buy service stations in Spain, France, and the Federal Republic of Germany, and eventually in Asia and North America.

After the supertanker *Bridgton* hit a mine in the Persian Gulf, U.S. naval forces successfully escorted several convoys of reflagged Kuwaiti tankers. Although the concern over the possible disruption of oil trade through the gulf by warfare was well publicized, little attention was paid to the potential for a serious disruption to the international nitrogen fertilizer trade. The British Sulfur Corp. Ltd. estimated that the gulf region was the source of perhaps 12% of the world's urea and ammonia exports during FY 1985, and of this Kuwait contributed 20%.

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

Commodity	1983	1984	1985	1986[p]	1987[e]
Cement ---------- thousand metric tons	1,124	1,184	1,193	1,014	1,014
Clay products, nonrefractory: Sand-lime bricks cubic meters	e450,000	e450,000	336,200	336,000	336,000
Gas, natural:[2]					
Gross ---------- million cubic feet	r192,000	205,000	190,000	190,400	3182,000
Marketed ---------- do	r151,000	173,000	172,000	172,300	3165,000
Lime: Hydrated and quicklime --- metric tons	e14,000	15,000	52,400	57,198	57,200
Natural gas liquids[4] thousand 42-gallon barrels	20,075	r24,455	19,710	27,375	329,200
Nitrogen: N content of ammonia -- metric tons	r313,200	289,800	322,700	450,600	3577,500
Petroleum:					
Crude[2] ------ thousand 42-gallon barrels	384,888	424,200	374,000	518,600	3496,770
Refinery products:					
Gasoline, motor ---------- do	9,855	8,760	r e10,000	11,000	11,000
Jet fuel ---------- do	8,030	5,110	r e6,000	6,000	6,000
Kerosene ---------- do	16,425	8,030	e10,000	10,000	10,000
Distillate fuel oil ---------- do	47,815	37,960	r e45,000	47,000	47,000
Residual fuel oil ---------- do	70,810	66,430	e79,000	82,000	82,000
Refinery fuel and loss ---------- do	1,095	5,840	e7,000	7,000	7,000
Other ---------- do	27,010	41,975	e50,000	52,000	52,000
Total ---------- do	181,040	174,105	r e207,000	215,000	215,000
Salt ---------- metric tons	e20,000	21,000	21,000	21,000	21,000
Sodium and potassium compounds: Caustic soda do	e9,000	9,500	9,800	9,800	9,800
Sulfur:					
Elemental, petroleum byproduct ---- do	e145,000	e151,000	e198,000	260,000	3383,250
Sulfuric acid ---------- do	e15,000	e4,495	4,600	4,600	4,600

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 17, 1988.
[2]Includes Kuwait's share of production in the Kuwait-Saudi Arabia Divided Zone.
[3]Reported figure.
[4]Gas plant liquids.

COMMODITY REVIEW

INDUSTRIAL MINERALS

Cement.—Near yearend, the Ras al-Khaimah-based Gulf Clinker Co. was scheduled to be liquidated and the approximately $20 million in assets was to be returned to Kuwaiti and United Arab Emirate investors. Assets included about $14 million cash and 22 million shares in the Ras al-Khaimah White Cement Co., worth $6 million. Gulf Clinker was formed in 1983 when a thriving local cement market was at its peak. Demand had since fallen by at least 25%, and the scheme's viability had become questionable.

Fertilizer Materials.—Nine international companies were placed on a short list of potential candidates by Petrochemical Industries Co. (PIC) to design, supply, erect, and commission a new hydrogen recovery unit at PIC's ammonia complex. The system would process waste gas to recover hydrogen, thereby enabling PIC to produce extra ammonia more efficiently.

MINERAL FUELS

Petroleum.—*Production.*—KOC announced the need for a contractor to construct a KOC-designed central water injection plant on a turnkey, lump sum basis. The 100,000 bbl/d system would service 13 oil wells, and water would be obtained from 5 aquifer wells between 610 and 2,440 meters deep, within 1 kilometer of the plant site.

Refining.—Modernization of the Mina Abdullah refinery was scheduled for completion by the end of 1987. The project, which began in 1983 by Kuwait National Petroleum Co. (KNPC), would raise the refinery's capacity from 75,000 bbl/d to 200,000 bbl/d. It would also enable the refinery to process crude oil into a wide variety of high-quality products and would reduce to a minimum the production of heavy fuel oils. The refinery's existing units were being upgraded. Although 15 new units and 17 ancillary units were under construction, a sea island and oil products export facilities were also being constructed. In addition, a new pipeline network would connect Kuwait's three refineries Mina al-Ahmadi, Mina Abdullah, and Shuaiba for product exchanges. Kuwait's refining capacity was expected to rise from 545,000 to 670,000 bbl/d, which would be about 66% of Kuwaiti crude oil production.

KNPC contracted with Santa Fe Braun Co., the engineering subsidiary of KPC, for feasibility studies to upgrade the fluid catalytic cracker unit, a new methyl tertiary-butyl ether and alkylate units for Mina al-Ahmadi refinery. Maintenance of instrumentation, control systems, and telecommunications at the refinery was to be provided by M. W. Kellogg Co. under a new contract with KNPC. KNPC received 13 bids for a contract to build a petroleum products tank farm and distribution system in south Ahmadi.

KOC announced that 15 international companies prequalified for a turnkey contract to upgrade and install gas-oil separator trains, install crude oil dehydration and desalting facilities and storage tanks, and perform associated mechanical and electrical work.

KNPC agreed that the Aden, South Yemen, refinery would process 20,000 bbl/d of Kuwaiti oil, an increase over the previous 10,000 bbl/d.

Petrochemicals.—Petrochemical Industries Co.'s (PIC) polypropylene plant, which was proposed in 1985 for construction in Shuaiba, was put on hold until KNPC decided to expand the fluid catalytic cracking unit at Mina al-Ahmadi refinery. The expansion would allow 25% to 30% more polypropylene to become available for PIC's plant.

PIC awarded a $1.6 million contract to Lurgi of the Federal Republic of Germany to install a purge gas hydrogen recovery unit that will recover hydrogen from waste gas from three ammonia plants at the Shuaiba fertilizer complex, thereby enabling PIC to produce extra ammonia more efficiently. VEB Komplette Chemieanlagen Dresden of the German Democratic Republic designed the cryogenic technology and equipment to be used.

Mitsubishi Heavy Industries received a $2.2 million contract to supply two reactors for the Shuaiba urea plant by July 1988.

Transportation.—Santa Fe Braun Co., completed its feasibility studies for two versions of a Kuwait-Yanbu pipeline that would allow Kuwait to reduce its reliance on the gulf as an export channel. The favored plan was to link a 42-inch, 500,000-bbl/d oil line from Kuwait to pumping station No. 3 on Saudi Arabia's east-west pipeline, but detailed cost estimates were required. The Government's interest in the project increased as a result of three fires

that started nearly simultaneously in January at an oil well and gathering center in the Maqwa Oilfield, at the Sea Island supertanker terminal, and later because of a missile hit at Sea Island. Kuwait had a fleet of 22 tankers and chartered nearly 70 ships to carry its exports of crude oil and refined products. Since the start of the Iran-Iraq war, over 41 Kuwaiti-owned and chartered ships have been damaged while crossing the Persian Gulf, and one-half of the Kuwaiti tanker fleet was put under the U.S. flag and the protection of the U.S. Navy in June.

The Kuwait Oil Tankers Co. (KOTC), a subsidiary of KPC, agreed to pay $132 million to the South Korean Samsung Shipbuilding Co. for the construction of six new products tankers; two with a capacity of 120,000 deadweight tons (dwt) and four of 35,000 dwt. Delivery was scheduled for 1988 to coincide with the completion of work on the modernization and expansion of Kuwait's oil refineries at Mina Abdullah, Mina al-Ahmadi, and Shuaiba.

KOTC's very large crude carrier (VLCC) *Kazimah* was converted to a very large products carrier (VLPC), and became the world's largest products carrier at 294,700 dwt. The *Kazimah* would normally carry naphtha, gasoline components, jet fuel and/or fuel oil to Kuwait's European market network, but it can carry crude oil if necessary to Kuwaiti refineries in the Netherlands, 75,000 bbl/d, and Denmark, 57,000 bbl/d. The 285,500-dwt VLPC *Al-Funtas* was similarly converted from a VLCC in 1983 and has been used to deliver combined cargos of crude oil, naphtha, and fuel oil to the Netherlands. KOTC was planning to convert its 263,700-dwt *Al-Faiha* soon.

KOTC sold its only liquefied natural gas carrier, the 125,000-ton *Al-Rawdatain* to a Liberian buyer.

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[1]Physical scientist, Division of International Minerals.
[2]Oil and Gas Journal. Sept. 1987, p. 21.
[3]Where necessary, values have been converted from Kuwaiti dinars (KD) to U.S. dollars at the rate of KD0.30085=US$1.00 (1985), KD0.29054=US$1.00 (1986), KD0.2825=US$1.00 (1987).

The Mineral Industry of Liberia

By David J. Ellis[1]

Liberia's iron ore exports, which accounted for more than 50% of export revenue, decreased as a result of a midyear cutback in production by LAMCO Joint Venture (LJV), the larger of the two remaining iron ore producing companies in Liberia. LJV's reserves were expected to be exhausted by 1990, so the development of fresh reserves had been a priority for LJV management and the Government of Liberia. The best solution for Liberia lay in the possibility of using existing LJV infrastructure to exploit the Mifergui-Nimba iron ore deposits on the border between Liberia and Guinea. A final decision on the project was still pending at yearend 1987 despite frequent meetings between representatives of the Governments of Guinea, Liberia, and Nigeria, and despite the urgency of the project in light of LJV's dwindling iron ore reserves at its current operations near Yakepa.

Small-scale exploitation of alluvial gold and diamonds continued, as did the exploration of a hard-rock gold deposit at Kle Kle by Equinox Resources Ltd. of Canada. Amoco Liberian Oil Co. withdrew its drilling rigs after completing four unsuccessful offshore wells.

PRODUCTION AND TRADE

Exports of iron ore remained the mainstay of Liberia's economy, despite the decrease in both production and shipments. Total production and exports declined 10% and 7%, respectively, compared with 1986 levels. Bong Mining Co. (BMC) showed a slight improvement over the previous year, with production of 7.15 million tons and exports of 7.31 million tons (versus production of 7.14 million tons and exports of 6.92 million tons in 1986).

LJV's midyear production cutback was reflected in decreases of almost 20% in both production and exports, compared with those of 1986. LJV's reported production of 6.595 million tons of iron ore was the lowest since its operations started in 1963.

The Federal Republic of Germany was the principal market for Liberian iron ore, purchasing 40% of total exports. The other major recipients were, in descending order, Italy, 24%; France, 8.6%; Belgium, 6.9%; and the United States, 6.6%.

Gold and diamonds were the only other minerals with a notable role in Liberia's economy. However, most production was by independent producers working alluvial deposits, and a large percentage of total production was never recorded. Official exports of gold were estimated to be about 15,000 troy ounces, compared with a little over 20,000 troy ounces the previous year. The actual amount of diamonds exported legally was probably about 250,000 carats (industrial and gem quality combined).

As is evident from iron ore exports, Western Europe and the United States remained Liberia's main trading partners. Although Liberia maintained a trade surplus in 1987, there continued to be a deficit of over $100 million on the overall balance of payments. This deficit was a reflection of loan payments coming due at the same time as private capital outflows maintained high

levels. The outflow of capital led to a scarcity of U.S. dollars (ostensibly set at par with the Liberian dollar) and the development of an unofficial dual currency system, where the Liberian dollar was worth, on average, about 50% of its U.S. counterpart. The Liberian Government continued to mint new Liberian currency to cover payrolls for civil servants and other domestic obligations. The amount of Liberian currency in circulation increased fivefold between 1984 and 1987.

The high budget deficit and Liberia's inability to service its swelling debt burden caused the International Monetary Fund and the International Bank for Reconstruction and Development (World Bank) to suspend services to Liberia in 1987. Negotiations between these two organizations and the Government of Liberia continued in the hope of improving Liberia's fiscal controls to the point where new loan credits would become available.

Table 1.—Liberia: Production of mineral commodities

Commodity[1]	1983	1984	1985	1986[p]	1987[e]
Cement, hydraulic thousand metric tons	85	84	95	97	90
Diamond:[e]					
Gem thousand carats	132	108	66	63	60
Industrial do	198	132	72	189	190
Total do	330	240	138	252	250
Gold[e] troy ounces	15,400	[2]10,500	[2]4,900	[2]20,100	15,000
Iron ore thousand metric tons	14,937	15,100	15,318	15,295	[3]13,742

[e]Estimated. [p]Preliminary.
[1]In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) were produced, but available information is inadequate to make reliable estimates of output levels.
[2]Figures are based on gold taxed for export and may include gold produced outside Liberia.
[3]Reported figure.

COMMODITY REVIEW

METALS

Gold.—Equinox Resources continued diamond drilling on the Kle Kle property northwest of Monrovia. This was the only ongoing hard-rock investigation in Liberia. Three other operations were reported to be conducting small-scale exploration and production on alluvial concessions, and there were numerous independent claims operators working on various gold-bearing streams.

Iron Ore.—The year began inauspiciously for the iron and steel industry in general, as iron ore prices slumped yet again early in the year, and there were reports of steel mill closures in Europe. The increased use of very large combination carriers (ships of more than 150,000 deadweight tons) and ultralarge combination carriers (ships of more than 300,000 deadweight tons) seemed to give a market edge to Australian and Brazilian iron ore producers.[2] In March, there were media reports of attempts by Gränges International Mining AB (Sweden), the manager of LJV, to declare bankruptcy and shut down its Liberian operations. A decline in European sales had led to formation of a stockpile at the port of Buchanan, and with lower iron ore prices LJV's income had decreased to less than operating cost. After meetings between Gränges representatives and members of the Liberian Government, it appeared that the reports of bankruptcy resulted from a misunderstanding, although it was acknowledged that LJV was having financial difficulty. Several short-term alternative solutions were proposed by LJV management, and counterproposals were tendered by the Liberian Government. A technical committee was formed to consider the alternatives and to report findings at LJV's midyear board meeting. There were two alternatives. The first was increasing output to capacity for the remainder of 1987 and suspending mining operations in 1988 while supplying customers with stockpiled material. The second was cutting production to 4 million tons per year through 1989, in conjunction with implementing further

cost-saving measures and some work force reductions. The latter option was chosen because it affected fewer jobs, and production was curtailed for the remainder of 1987.

Meanwhile, several rounds of meetings and negotiations between committed and potential investors in the prospective Mifergui-Nimba iron ore project were held during the year. The Governments of Guinea, Liberia, and Nigeria; LJV; and the Bureau de Recherches Géologiques et Minières (BRGM) of France were principal investors in the project and were trying to get the balance of the funding from sources such as the World Bank, the International Finance Corporation, the European Investment Bank, and Caisse Centrale de Cooperation Économique of France. The major obstacle to implementation of the joint venture was that few European steel mills would commit to long-term contracts for the ore. The reasons for this reluctance were rooted in the depressed state of the steel market and the ability of Australian and Brazilian producers to supply bulk loads of iron ore at competitive prices.

As a result of negotiations held during an April LJV board meeting, LJV and Société de Coopération Minière et Industrielle (Socomin), a subsidiary of BRGM, were commissioned to prepare a new feasibility study; the results provided at LJV's June board meeting recommended an output of 12 million tons of ore beginning in 1990, with 10 million tons of ore from Guinea and 2 million tons of upgraded ore from Tokadeh in Liberia. The capital cost was still estimated to be about $300 million. Since LJV's currently exploited ore bodies were expected to be worked out by 1990, and construction work to get the Mifergui-Nimba project ready for production would take 2 years, it was considered imperative to begin work on Mifergui-Nimba by year-end to avoid a break in service to LJV's customers.

Another possibility, which had long been considered as an alternative to the Mifergui-Nimba project, was the use of BMC processing facilities for the upgrading of LJV's Western Reserve area ore. The Western Reserve included ore bodies at Mount Gangra, Mount Tokadeh, and Mount Yuelliton, west and south of current LJV operations at Yakepa, which were estimated to contain over 500 million tons of iron ore with an average grade of slightly over 50% Fe. Infrastructure necessary to implement the project would include a 112-kilometer rail link between the existing LJV railroad and BMC's processing facilities. As was the case with the Mifergui-Nimba scheme, financing was the stumbling block of the project, with development costs estimated to be about $150 million.

BMC had a much more stable year owing to a fixed market for its iron ore. BMC was owned by a steelwork consortium of companies in the Federal Republic of Germany and Italy, represented by purchasing agents Rohstoffhandel GmbH and Societa Finanziaria Siderúrgica S.p.A., respectively. These Western European firms had long-term contracts for BMC iron ore and provided the market for all of BMC's output in 1987.

In November, it was announced that the European Economic Community gave Liberia $50 million for the purchase of new equipment to be used in the development of a new ore body by the BMC. This aid was part of a $110 million modernization program, instigated by the Liberian Government, which would allow BMC to continue operations into the early part of the 21st century.

There was no change in the status of the National Iron Ore Co. (NIOC) mine, which closed in 1985, despite Liberian media reports of negotiations for a reopening of the mine in Grand Cape Mount County. About 150,000 tons of NIOC iron ore stockpiled at Monrovia remained in financial and legal limbo.

Scrap.—Third World Shipbreaking Inc., which started operations in Liberia in 1986, announced plans for construction of an 18,000-ton-per-year steel-rolling mill. Preliminary production was scheduled to begin in mid-1987 using stockpiled scrap.

MINERAL FUELS

Amoco Liberian Oil, which had been exploring for oil off the coast of Liberia, withdrew its operations in December 1986 after drilling four unsuccessful wells.

Following the cancellation of an agreement made in 1986 between the Government of Liberia and two United States-based consortia for the privatization of the Liberian Petroleum Refining Co. (LPRC), it was announced in September 1987 that Linkoil International of Dallas, Texas, would take over the LPRC. Linkoil was chosen from a group of approximately 20 interested investors and was slated to assume responsibility for the rehabilitation of the LPRC refinery at Monrovia, which closed in 1983 because of cost overruns.

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[1]Physical scientist, Division of International Minerals.
[2]Metal Bulletin Monthly (London). No. 194, Feb. 1987, pp. 59-61.

The Mineral Industry of Libya

By Thomas O. Glover[1]

Libya's economic situation continued its downward trend during the year. Crude oil production, accounting for most of Libya's foreign exchange, fell by over 5% from that of 1986. Crude oil sales and prices also fell during 1987. The United States continued trade, financial, and other sanctions against the country.

Libya dropped from second to third place among African oil producers. Nigeria continued to be the top oil producer with Algeria moving up to second place. Libya had reserves of 21 billion barrels by yearend, most of which were high-quality light crudes. At present rates of production, reserves were in excess of 50 years.

Owing to declining oil production and prices, Libya's gross domestic product (GDP) was estimated at $17.9 billion[2] compared with $18.6 billion in 1986. Oil accounted for approximately 50% of the GDP and 99.9% of all export earnings. Libya, in response to dwindling Government revenues from oil exports, instituted austerity measures that included a restrictive budget during 1987. The country allocated $453.4 million for development. This amount was 15% less than in 1986, and consequently, some infrastructural projects suffered. Imports were further curbed by 2.8% from 1986 imports. The devaluation of the Libyan dinar in March 1986 led to further inflationary pressures during 1987.

Libya responded to losses in foreign exchange, owing to slumping oil revenues, by attempting to increase productivity in the agricultural and cement industries. Although the agricultural industry remained sluggish, cement production rose by 30% more than that produced in 1986. The value of cement also increased during the year.

The great manmade river (GMR) project, a 600-kilometer twin pipeline extending from artesian fresh water wells in the southwestern desert to northern Libyan agricultural centers near Tripoli, continued to progress. Work started on the 15-megawatt Sarir power station, an integral part of phase 1 of the GMR project. The power station project, valued at $59.5 million, was awarded to Japan's C. Itoh & Co. Ltd. in 1986; however, the project could not begin owing to delays in arranging a cash payment. The work was expected to be completed in approximately 18 months. Phase 2 of the GMR project, valued at $1,800 million, was put off until 1988. Another water project, slated to commence in 1987, at a cost of $63.3 million, was building a desalination plant at Al-Marj. At yearend, the project had not commenced owing to the financial constraints. Payment was to be made in oil.

PRODUCTION AND TRADE

Libya's principal sources of foreign exchange continued to be its exports of crude oil and petrochemical products. Production of crude oil was 1,007,000 barrels per day (bbl/d), a decrease of 5.5% less than that of 1986. Libya required support and technologies from other Western countries for its exploration and production of crude oil.

Libya's crude oil production for the year exceeded by approximately 5% its quota of 955,000 bbl/d set by the Organization of Petroleum Exporting Countries (OPEC). The quotas applicable to the various producing companies were approximately as follows, in barrels per day:[3]

Waha (formerly Oasis Oil Co. of Libya Inc.) in partnership with the Libya National Oil Co. (LNOC)	335,000
Arabian Gulf Exploration Co. (AGECO), Umm al-Jawab. (LNOC for crudes from the Akmna and Sarir Fields)	300,000
Azienda Generali Italiana Petroli S.p.A. (AGIP) with LNOC	110,000
Zueitina (formerly Occidental Petroleum Corp.) with LNOC	90,000
Sirte Oil Co. (formerly Esso Sirte Oil Co.) with LNOC	60,000
Verba (formerly Mobil Oil Libya Ltd.) with LNOC	50,000
Wintershall	8,000
Aquitaine Group	2,000
Total	955,000

In 1987, the United States renewed the trade boycott against Libya that originated as an Executive order issued on January 7, 1986. The order virtually banned all direct economic activities between the United States or U.S. nationals and Libya. The impact of the trade boycott on Libya was minimal owing to the extensive alternative foreign sources of oilfield equipment, services, and supplies. Because other countries did not join the United States on the trade boycott of Libyan oil, the Libyan Government was able to sell all the oil it produced to other foreign countries.

Libya continued to barter its oil for much-needed goods and services. Turkey agreed to accept up to 5 million tons of crude oil during the year to settle overdue construction bills, and in exchange for Libya's future purchases of iron and diesel oil. Libya and Malta were also involved with bartering of goods and oil. Under the barter, Libya exported crude oil to Malta worth $60 million. Under another barter agreement worth $60 million, Uganda would receive cement, fertilizer, gypsum, and oil from Libya for Uganda's agricultural products. The oil from Libya would amount to 75% of Uganda's oil imports. Libya was scheduled to supply Sudan with 600,000 tons of crude oil during the year. Libya was scheduled to barter oil to Sweden's Armerad Betong Vagforbattringar AB to service a debt from several construction projects carried out in Libya. Under this agreement, Libya was scheduled to deliver $9 million worth of oil to Sweden by the end of the year.

Table 1.—Libya: Estimated production of mineral commodities[1]

Commodity[2]	1983	1984	1985	1986[p]	1987[p]
Cement, hydraulic thousand metric tons	5,000	6,000	6,500	[3]2,077	[3]2,700
Gas, natural:					
Gross million cubic feet	258,000	295,000	292,000	292,000	292,000
Marketed[4] do.	150,000	150,000	150,000	150,000	150,000
Gypsum thousand metric tons	180	180	180	180	180
Iron and steel: Steel, crude metric tons	10,000	10,000	10,000	10,000	10,000
Lime thousand metric tons	260	260	260	260	260
Nitrogen: N content of ammonia do.	445	494	411	411	411
Petroleum:					
Crude thousand 42-gallon barrels	[r]404,785	[r]405,515	392,375	389,090	367,555
Refinery products:					
Naphtha do.	4,000	4,000	6,000	6,000	6,000
Gasoline do.	5,000	5,000	7,000	7,000	7,000
Kerosene and jet fuel do.	7,000	7,000	11,000	11,000	11,000
Distillate fuel oil do.	10,000	10,000	15,000	15,000	15,000
Residual fuel oil do.	10,000	10,000	15,000	15,000	15,000
Other do.	600	600	1,000	1,000	1,000
Refinery fuel and losses do.	900	900	2,000	2,000	2,000
Total do.	37,500	37,500	57,000	57,000	57,000
Salt thousand metric tons	12	12	12	12	12
Sulfur, byproduct of petroleum and natural gas do.	14	14	14	14	14

[p]Preliminary. [r]Revised.

[1]Table includes data available through May 25, 1988.

[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]Reported figure.

[4]Excludes gas reinjected into reservoirs.

COMMODITY REVIEW

METALS

Aluminum.—The Zuwarah aluminum metal plant construction near Tripoli, initiated in mid-1985, remained on hold for the second consecutive year owing to Libya's poor economic condition.

Iron and Steel.—The Misurata iron and steel plant, the largest single industrial enterprise in Libya, failed to startup during 1987 as planned. The plant's phase-1 startup was awaiting Government approval of the operating budget. The $6 billion complex was expected to commence operations in 1988, which makes it several years behind schedule. The plant, scheduled to employ more than 5,000 people, was expected to be one of the largest in the Arab world.

The Misurata iron and steel plant, 130 miles east of Tripoli, will cover an area of 21.6 square miles when both phases of construction are completed. Phase 1, awaiting startup in 1988, occupies only 4.6 square miles of the total plant area and has a designed annual capacity of 1,324,000 tons of liquid steel. When phase 2 is completed, the annual capacity of the entire plant will be 6,324,000 tons. The plant was designed to handle feed containing either 100% iron oxide pellets or 60% pellets and 40% lump ore, which could be furnished by Brazil or Sweden. Libyan natural gas was to be used to reduce the imported pellets.

INDUSTRIAL MINERALS

Cement.—Libyan cement production increased 30% more than 1986 production to 2.7 million tons. The value increased by 46% to $139 million. Studies have been completed on using natural gas rather than fuel oil to heat kilns and on computerizing operations. Studies are also under way on the construction of a plant to produce cement bags. Plans are being formulated to standardize cement prices in Libya. Libyan cement was used in the production of prestressed cement pipe for the GMR project. The pipe was manufactured at al Brega and Sarir.

Gypsum.—A five-member Scandinavian consortium planned to revive a gypsum project in Libya this year. The $50 million extraction and processing scheme had been delayed by security concerns in Libya. The project called for setting up a gypsum mine and processing plant near Tripoli. Annual production of 300,000 tons was planned for the mine. The project was to be partly financed through an oil barter arrangement.

Limestone.—A $38.2 million contract to develop the Sedada dolomitic limestone quarry in Libya was awarded to Turkey's Sezai Turkes-Feyzi Akkaya. The company was scheduled to develop the on-site facilities. The 2.7-acre site was scheduled to produce 705 tons of dolomitic limestone per day after the 20-month contract was completed. The raw dolomitic limestone was scheduled to be utilized by the Misurata iron and steel complex. The method of payment for the $38.2 million project called for neither oil barter nor deferred payment.

MINERAL FUELS

Natural Gas.—An agreement was reached between Libya and Turkey on setting up a liquid natural gas (LNG) plant as a joint venture during the year. Algeria, Libya, and Tunisia have agreed to set up a joint company to build a natural gas pipeline among the three countries. It was reported that it was cheaper for Libya to import Algerian natural gas than to increase the use of its own resources. Libya was scheduled to purchase 3.0 to 3.5 billion cubic meters per year of Algerian natural gas. Because of the age and condition of the Libyan plants Spain's Enagas was unwilling to renew Libya's LNG contract that expires in 1992. Libya's LNG supplies to Spain may be replaced by Soviet supplies of 1.0 to 1.5 billion cubic meters of LNG annually for 20 years.

Petroleum.—*Exploration.*—An agreement to set up a joint geophysical and oil exploration program between Libya and Algeria was signed by both parties on November 11, 1987. The agreement also called for Algerian natural gas sales to Libya. The Libya National Oil Co. (LNOC) has discovered oil in the offshore area near the Province of Benghazi for the first time. Further exploration was planned for the near future. LNOC has sunk 45 exploratory wells offshore with several oil and gas discoveries. The most important of the discoveries was the Bouri Field, scheduled to come onstream in May 1988 at a preproduction cost of $2 billion. To keep within its quota, which was set by OPEC, the Bouri Field was set to maximize output at 50,000 bbl/d over the next 2 to 3 years.

Production.—The African Petroleum Pro-

ducers' Association (APPA) was formed in January 1987 by eight African oil exporting countries: Algeria, Angola, Benin, Cameroon, Congo, Gabon, Libya, and Nigeria. Algeria, Gabon, Libya and Nigeria also belonged to OPEC. Nigeria, the major producer in APPA, was responsible for forming the association. Libya was the third-ranked producer of APPA, producing 1,007,000 bbl/d in 1987. Only Nigeria and Algeria produced more oil than Libya. APPA represents about 80% of the total African oil production. Libya resumed supplying substantial volumes of crude oil to the Soviet Union after more than a year of disruption. The deliveries resumed in October 1987, averaging 80,000 to 100,000 bbl/d. Libya's oil revenues for 1987 were estimated to be $5.6 billion, up approximately 17% from that of 1986. Libya supplied 15% of Italy's oil needs during the year.

Refining.—Libya's three oil refineries had a throughput crude oil capacity of 329,400 bbl/d, with catalytic cracking accounting for 14,600 bbl/d. Exports of refinery products to the European Economic Community increased during the year compared with exports in 1986. Libya requested bids from various countries for design, procurement, and construction supervision of the Azzawiya oil refinery renovation. Several companies returned offers; however, by yearend, no action had been taken by Libya. The refinery commenced operation as a 120,000-barrel-per-day unit in 1977, and it has added an additional capacity of 60,000 bbl/d. Crude supplies were piped from the onshore El Hamma and Emgayet Fields. The refinery was also close to the offshore Bouri Field, which was being developed.

Petrochemicals.—Petrochemical exports from Libya to 22 countries increased by 6% in 1987 to 2.4 million tons. New petrochemical customers in 1987 were Colombia, Hong Kong, Peru, and the Philippines. European traders took the first cargoes of ethylene from the new Ras Lanuf petrochemicals complex. The first phase of the complex was commissioned in April 1987. The new plant had a rated capacity of 330,000 tons per year. The second phase of the petrochemical complex, put out for bids in 1987, contemplates the production of benzene, butadiene, methyl tertiary butyl ether, polyethylene, and polypropylene. No capacities have been disclosed. Libya was looking to Europe for technology to run the new proposed second phase. The cost of the proposed second phase was $300 to $400 million. By yearend, 15 international contractors were prequalified.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Libyan dinars (LD) to U.S. dollars at the rate of LD0.3127 = US$1.00.

[3]Middle East Economic Survey (Nicosia, Cyprus). V. 30, No. 19, Feb. 16, 1987.

The Mineral Industry of Madagascar

By Kevin Connor[1]

Commercial mineral production on the island nation remained, in order of importance, graphite, chromite, semiprecious stones, and mica. Other major mineral commodities produced, for local consumption, were cement and refined petroleum products. The mineral industry continued to produce small tonnages of a variety of industrial minerals for domestic consumption. Kraomita Malagasy, a Government parastatal, remained the only chromite producer on the island in 1987, with its sole operation at Andriamena. The state agency continued to suffer from severe technical and financial problems. QIT-Fer et Titane Inc. (QIT) of Montreal, Quebec, Canada, which signed a joint-venture agreement with the Government of Madagascar in early 1986, was continuing throughout the year with its project for the development of titanium-bearing sands along the island's southeast coastline. The Government of Madagascar spent approximately 17% of its public investment budget on the minerals sector in 1987. The Government's plans for 1988 were to double this proportion.

Government Policies and Programs.—The U.S. Trade and Development Program (USTDP) in March awarded a grant to Madagascar to further study the feasibility of a ferrochrome plant at Moramanga near the Andriamena chromite deposits and nearby Andekaleka hydroelectric dam. The estimated funding level of the grant was $400,000. Although the USTDP expressed continued interest in a proposal for platinum exploration, originally presented in 1986 to the USTDP by Madagascar's Office Militaire National pour les Industries Strategiques (OMNIS), no agreement for funding the project had been reached by yearend. The platinum proposal would involve exploration in the Andriamena area where the country's chromite mines were located. Interest in this project was also expressed by the French agency, Bureau de Recherches Géologiques et Minières (BRGM). OMNIS was hopeful of eventually forming a joint venture with a private firm to develop any commercial platinum deposits discovered.

French and U.S.S.R. funding and technical assistance in the search for precious metals continued, as did financial assistance from the International Development Agency of the World Bank, for evaluating the development potential of the Tsimiroro tar sands.

PRODUCTION AND TRADE

Madagascar's chromite production increased by more than 20% compared with 1986 levels. However, it was still only approximately one-half of the chromite ore produced annually by Kraomita Malagasy in the 1970's. Exports of chromite ore and concentrate were steady, approximately matching production levels. A total of 96,227 tons of chromite concentrates was sold at an approximate value of $4 million.[2] Graphite production and exports were steady, with export receipts estimated at $5.5 million. The total value of exports for the ornamental and semiprecious stones was estimated to be more than the mica trade, which was reported to be about $300,000 for the year. Madagascar continued to export small quantities of scrap metal, salt, abrasives, and cement. Also, as in previous years, small quantities of by-products from the country's sole petroleum refinery at Tamatave were exported to neighboring islands. Export receipts from mineral commodities produced continued to represent less than 1% of the country's gross domestic product and less than 5% of all export receipts.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Bastnasite[e] kilograms	25,000	25,000	9,000	10,000	10,000
Beryllium: Beryl in quartz, concentrates, industrial and ornamental	[r]121	46	50	[e]50	50
Chromium: Chromite concentrate, gross weight	45,729	59,765	127,415	82,910	[3]106,600
Gold, mine output, Au content[e] troy ounces	110	130	130	130	130
INDUSTRIAL MINERALS					
Abrasives, natural, (industrial only)[e] kilograms	7,000	10,000	10,000	10,000	10,000
Cement, hydraulic[e]	35,000	35,000	35,000	35,000	35,000
Clays, kaolin[e]	2,500	2,500	[3]6,367	6,000	[3]1,427
Feldspar[e] kilograms	1,800	1,800	[3]5,195	5,000	5,000
Gem stones:					
Amazonite do	8,910	6,162	5,519	[e]5,500	[3]3,783
Amethyst:					
Gem do	15	10	11	[e]10	[3]11
Geodes do	4,300	4,300	8,550	[e]9,000	9,000
Citrine do	12	46	372	[e]400	[3]6
Cordierite do	27	10	762	[e]800	[3]387
Garnet do	1,196	2,603	1,201	[e]1,500	1,500
Tourmaline do	7	2	2	[e]2	2
Graphite, all grades	13,557	13,973	13,971	16,187	[3]13,169
Mica, phlogopite:					
Block	28	26	25	[e]100	[3]25
Scrap	619	623	500	[e]1,300	[3]300
Splittings and sheet	72	71	64	[e]194	[3]77
Total	719	720	589	1,594	[3]402
Ornamental stones:					
Agate kilograms	8,450	9,300	8,042	[e]8,000	[3]14,034
Apatite do	3	3,500	3,500	[e]3,500	[3]1,948
Aragonite	1,226	809	991	[e]1,000	[3]500
Calcite	600	1,584	1,160	[e]1,000	[3]2,934
Celestine kilograms	29,644	30,000	29,974	[e]30,000	[3]4,365
Jasper do	17,000	16,425	16,300	[e]16,000	[3]19,730
Labradorite do	7,847	2,740	14,821	[e]15,000	[3]24,320
Other gem and ornamental[e]	125	150	200	250	250
Quartz:					
Crystal kilograms	5,283	32,467	32,500	[e]32,500	32,500
Geodes do	3,000	2,970	3,000	[e]3,000	3,000
Hemotoid do	1,885	14,964	15,000	[e]15,000	[3]6,825
Other ornamental do	1,200	6,397	6,500	[e]6,500	[3]4,925
Rose quartz do	247,943	139,645	10,500	[e]50,000	[3]77,980
Smelting do	771,000	1,058,000	1,334,000	[e]1,000,000	1,000,000
Tourmaline do	5,231	26,558	1,100	[e]1,000	[3]276
Quartz, piezoelectric do	51	145	150	[e]150	150

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Salt, marine[e]	30,000	30,000	30,000	30,000	30,000
Stone:					
Calcite, industrial[e]	2,000	2,000	2,000	2,000	2,000
Dimension, marble, other[e]	2,000	2,500	3,000	3,000	3,000
Marble, cipoline	100	113	35	[e]110	[3]5
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Distillate fuel oil, thousand 42-gallon barrels	734	129	598	[e]600	600
Gasoline, do.	242	87	454	[e]450	450
Kerosene and jet fuel, do.	175	49	304	[e]300	300
Other, do.	13	2	30	[e]30	30
Residual fuel oil, do.	1,026	142	729	[e]730	730
Total, do.	2,190	409	2,115	[e]2,110	2,110

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

[1]Table includes data available through June 29, 1988.

[2]In addition to the commodities listed, modest quantities of unlisted varieties of crude construction materials (clays, sand and gravel, and stone) presumably are produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Destinations, 1985	
			United States	Other (principal)
METALS				
Chromium:				
Ore and concentrate	26,824	27,277	--	China 13,793; Italy 5,549; Belgium-Luxembourg 5,498.
Oxides and hydroxides	--	2	--	All to Mauritius.
Copper: Metal including alloys:				
Scrap	--	13	10	NA.
Unwrought	--	272	--	All to Belgium-Luxembourg.
Semimanufactures, value, thousands	$13	$2	--	All for ship stores.
Iron and steel: Metal:				
Steel, primary forms, do.	--	$1	$1	
Semimanufactures:				
Bars, rods, angles, shapes, sections	1	1	--	All for ship stores.
Universals, plates, sheets	189	126	7	Belgium-Luxembourg 8; ship stores 93.
Hoop and strip	--	14	--	West Germany 1; ship stores 13.
Wire	--	1	--	All for ship stores.
Tubes, pipes, fittings, value, thousands	$1	$2	--	Belgium-Luxembourg $1; ship stores $1.
Lead: Metal including alloys, scrap	--	10	10	
Tungsten: Metal including alloys, all forms	(2)	2	--	All for ship stores.
Zinc: Metal including alloys, semimanufactures, value, thousands	$1	$1,594	--	Belgium-Luxembourg $25; ship stores $1,569.
Other: Ores and concentrates	--	76,211	--	All to Japan.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice etc, value, thousands	$8	--		
Artificial: Corundum	2	--		
Grinding and polishing wheels and stones, value, thousands	$1	--		
Cement	--	13	--	All to United Kingdom.
Clays, crude	486	--		
Graphite, natural	13,180	16,060	3,184	United Kingdom 6,530; West Germany 2,940.
Lime	127	26	--	United Kingdom 13; France 5.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Destinations, 1985	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Mica:				
Crude including splittings and waste	523	471	61	Belgium-Luxembourg 375; France 26.
Worked including agglomerated splittings	2	1	--	All to West Germany.
Precious and semiprecious stones other than diamond, natural value, thousands	$643	$1,002	$363	West Germany $267; Japan $141.
Salt and brine	8,612	11,216	--	France 4,861; Reunion 412; ship stores 5,644.
Sodium compounds, n.e.s.: Carbonate, manufactured	52	4	--	All to Mauritius.
Stone, sand and gravel:				
Dimension stone: Crude and partly worked	--	9	--	All to West Germany.
Quartz and quartzite	--	523	--	West Germany 396; Mauritius 127.
Sand other than metal-bearing	1,348	110	--	All for ship stores.
Sulfur: Sulfuric acid	49	17	--	United Kingdom 12; Italy 2.
Other: Crude	385	--		
MINERAL FUELS AND RELATED MATERIALS				
Coal: Anthracite	69,689	--		
Petroleum refinery products:				
Gasoline, motor--42-gallon barrels	9,444	5,542	--	Mainly for ship stores.
Kerosene and jet fuel --do--	11,160	11,749	--	Do.
Distillate fuel oil --do--	49,721	71,004	--	Do.
Lubricants--do--	728	213,423	--	Do.
Residual fuel oil --do--	35,385	81,265	--	Do.

[1]Table prepared by Virginia A. Woodson.
[2]Unreported quantity valued at $5,000.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals value, thousands	$4	--		
Aluminum:				
Ore and concentrate	197	--		
Oxides and hydroxides	10	9	--	All from France.
Metal including alloys:				
Scrap	34	9	--	All from Comoros.
Semimanufactures	187	311	(2)	France 269; Hong Kong 28.
Chromium: Oxides and hydroxides	5	24	24	
Copper: Metal including alloys, semimanufactures	66	54	(3)	France 37; China 11.
Iron and steel: Metal:				
Scrap	7	--		
Pig iron, cast iron, related materials	--	110	--	United Kingdom 107.
Ferroalloys: Ferromanganese	60	95	--	West Germany 75; France 20.
Semimanufactures:				
Bars, rods, angles, shapes, sections	7,610	4,754	18	France 3,400; Belgium-Luxembourg 756.
Universals, plates, sheets	11,966	9,952	23	France 8,983; Japan 287.
Hoop and strip	163	81	--	France 76.
Rails and accessories	403	2	--	Mainly from U.S.S.R.
Wire	2,276	2,014	1	France 1,672; Mauritius 309.
Tubes, pipes, fittings	5,434	970	74	France 651; Italy 143.
Lead:				
Oxides	12	10	--	France 9.
Metal including alloys:				
Scrap	--	2	--	All from France.
Unwrought	230	257	--	Do.
Semimanufactures	5	6	--	Do.
Magnesium: Metal including alloys, semimanufactures value, thousands	$2	--		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS —Continued				
Manganese:				
Ore and concentrate, metallurgical-grade	--	2	--	All from Hong Kong.
Oxides	76	90	--	All from West Germany.
Mercury ... value, thousands	$1	$7	$1	France $5.
Molybdenum: Metal including alloys all forms	1	--		
Nickel: Metal including alloys, semi-manufactures -- value, thousands	$1	$6	--	Mainly from France.
Platinum-group metals: Metals including alloys, unwrought and partly wrought do	$1	$1	--	All from France.
Silver: Metal including alloys, unwrought and partly wrought ... do	$5	$1	NA	NA.
Tin: Metal including alloys, semimanufactures	4	1	--	Mainly from France.
Titanium: Oxides	--	3	--	Mainly from West Germany.
Tungsten: Metal including alloys, all forms	3	--		
Zinc:				
Ore and concentrate	--	445	--	All from China.
Metal including alloys, semimanufactures	98	25	--	All from France.
Other:				
Oxides and hydroxides	292	130	--	Do.
Base metals including alloys, all forms	9	--		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc ... value, thousands	$10	$27	--	West Germany 26.
Artificial: Corundum	(4)	88	--	All from France.
Dust and powder of precious and semi-precious stones including diamond value, thousands	--	$4	--	Do.
Grinding and polishing wheels and stones	58	147	(2)	North Korea 127; France 17.
Asbestos, crude	70	2,099	NA	NA.
Barite and witherite value, thousands	$2	--		
Boron materials:				
Crude natural borates	82	75	--	Mainly from Belgium-Luxembourg.
Oxides and acids value, thousands	$3	--		
Cement	44,058	67,111	252	North Korea 31,310; U.S.S.R. 12,495; Kenya 8,717.
Clays, crude	1,071	10	--	China 8; France 1.
Diatomite and other infusorial earth	800	44	--	All from France.
Feldspar, fluorspar, related materials	--	72	71	NA.
Fertilizer materials:				
Crude, n.e.s ... value, thousands	--	$1	--	All from China.
Manufactured:				
Ammonia	15	29	--	France 27.
Nitrogenous	7,050	10,063	--	United Kingdom 6,506; France 2,753.
Phosphatic	2,429	4,204	--	Belgium-Luxembourg 3,000; France 984.
Potassic	5,742	2,529	700	France 1,421; Belgium-Luxembourg 408.
Unspecified and mixed	10,288	4,396	--	France 3,846; Belgium-Luxembourg 500.
Graphite, natural	4	--		
Gypsum and plaster	2,002	5,491	--	France 5,490.
Lime	396	258	--	Belgium-Luxembourg 250.
Magnesite	44	--		
Mica:				
Crude including splittings and waste	2	7	--	All from France.
Worked including agglomerated splittings	--	1	--	All from Japan.
Pigments, mineral: Iron oxides and hydroxides, processed	--	18	--	France 17.
Precious and semiprecious stones other than diamond: Natural value, thousands	$2	$1	NA	NA.
Salt and brine ... do	$36	$7	--	Netherlands $4; France $3.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	813	513	200	France 247; West Germany 50.
Sulfate, manufactured	2,166	2,705	16	France 1,965; West Germany 614.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	--	1	--	All from France.
Worked	9	--		
Gravel and crushed rock	21	--		
Quartz and quartzite	--	3	--	Do.
Sand other than metal-bearing	1	3	--	Do.
Sulfur:				
Elemental: Crude including native and byproduct	36	--		
Sulfuric acid	211	173	--	France 127; Netherlands 25.
Talc, steatite, soapstone, pyrophyllite	17	14	12	France 2.
Other: Crude	462	319	--	Mainly from West Germany.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	26	--		
Carbon black	71	137	--	West Germany 74; Canada 60.
Coal: Lignite including briquets	7,318	--		
Coke and semicoke value, thousands	$1	--		
Peat including briquets and litter	--	4,303	NA	NA.
Petroleum:				
Crude thousand 42-gallon barrels	718	1,443	--	U.S.S.R. 1,069; Saudi Arabia 373.
Refinery products:				
Liquefied petroleum gas do	31	10	--	Saudi Arabia 9.
Gasoline, motor do	1,226	617	--	Qatar 420; Yemen (Aden) 148.
Mineral jelly and wax do	13	40	--	China 26; West Germany 9.
Kerosene and jet fuel do	323	154	--	Yemen (Aden) 89; Bahrain 33.
Disillate fuel oil do	682	392	9	Yemen (Aden) 244; Saudi Arabia 51; Bahrain 41.
Lubricants do	116	53	(4)	Saudi Arabia 26; Kenya 18.
Residual fuel oil do	68	5	--	All from Mozambique.
Bitumen and other residues do	12	1	(4)	Mainly from France.

NA Not available.
[1]Table prepared by Virginia A. Woodson.
[2]Unreported quantity valued at $6,000.
[3]Unreported quantity valued at $4,000.
[4]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Gold.—Throughout most of the year BRGM searched for alluvial gold in the east-central rivers of Madagascar using a lightweight dredge specially designed for shallow waters. The French agency was to explore the Amabatolampy-Andravoravo and Ilea-Ambositra regions. The exploration and feasibility work was supported through financial assistance from the French Government and technical assistance from BRGM. Both of the areas under investigation were south of Antananarivo and east of Antsirabe. The areas had been mined for gold around the turn of the 19th century, with recorded production totals as high as 2,000 kilograms per year.

Titanium.—QIT of Canada continued with its plans to mine ilmenite from the Fort Dauphin area and ship it to Sorel, Quebec, Canada, where QIT's smelter at Richards Bay will process it into high-grade titanium. Early in the year, another large deposit of ilmenite was discovered on the company's concession in southeastern Madagascar. The new deposit lay beneath the already delineated 25-million-ton deposit on which mine plans were being developed. Estimated mining reserves were raised to 60 million tons, and planned initial mining capacity was raised from 300,000 to 600,000 tons per year of 60% TiO_2 concentrate.

Early in the year, a pilot-scale plant to produce heavy-mineral concentrate began operating to provide data for design and construction. The metallurgical design phase of the project was under way by

yearend, and plant design was expected to begin by mid-1988. The project schedule called for the mining operation to start by mid-1992. QIT's Richards Bay facilities were being expanded during the year to increase capacity to 1.4 million tons per year of slag. By the mid-1990's, most beach sand ilmenite consumed by the Richards Bay plant was expected to come from Madagascar. Completion of QIT's project in Madagascar was estimated to cost $500 million over a 5-year period.

INDUSTRIAL MINERALS

Madagascar continued to be an important, although small, producer of graphite. This was due to the high quality of its crystalline flake product. The majority of production was flake in 1987, with the remainder classified as fine flake. There were five producers of graphite in 1987: Société Minière de la Grande Ile, Etablissements Gallois, Etablissements R. Izouard, Société Louys, and Etablissements Rostaing. The largest producer was Etablissements Gallois, a private French operation which produced approximately one-half of the country's graphite from the Gallois Mine at Antsirakambo. The second largest producer was Société Minière de la Grande Ile, a Swedish-owned mining company, which was responsible for about one-fourth of the annual production from its mining operations at Ambatomitama.

MINERAL FUELS

During 1987, several international oil companies abandoned exploration on Madagascar. Poor results and the depressed international petroleum market were cited as reasons by the companies relinquishing their concessions.

A substantial natural gas deposit was discovered at yearend in the Manambolo area of west-central Madagascar. Estimated reserves were expected to be about 70 billion cubic feet. The Canadian Government discovered the gas deposit and also a heavy oil deposit at the same site as part of an exploration program to assist the Government of Madagascar in its search for indigenous petroleum. The natural gas deposit was the first such find in Madagascar.

The country's sole petroleum refinery at Tamatave continued to operate at below its rated capacity of 3.5 million barrels. The refinery produced an estimated 2.75 million barrels of distillates. Fuel oil, gas oil, gasoline, and kerosene were the major products of the refinery, in that order.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Madagascar francs (FMG) to U.S. dollars at the rate of FMG1,300=US$1.00.

The Mineral Industry of Malaysia

By John C. Wu[1]

Despite improvement in world prices of crude petroleum, tin, and other mineral commodities, total output of the mining industry remained essentially at the 1986 level, owing mainly to a production cutback in crude petroleum by the oil and gas industry. The cutback enabled Malaysia to support the Organization of Petroleum Exporting Countries (OPEC) plan to stabilize world oil prices. Mine output of the tin industry increased only slightly, resulting from reopening of some previously idled gravel-pumping tin mines. However, mine output of gold reached a record-high level, owing to the increased market price of gold in 1987.

The mineral industry, dominated by oil and gas production, remained an important sector of the Malaysian economy. Its output continued to contribute about 11% to Malaysia's gross domestic product (GDP) in 1987. Its export earnings, principally from exports of copper concentrate, crude petroleum, liquefied natural gas (LNG), tin, and other mineral commodities, such as bauxite and ilmenite concentrate, valued at $3.8 billion,[2] accounted for about one-quarter of Malaysia's total export earnings in 1987. Malaysia remained the world's largest tin producer and an important producer of bauxite, cement, copper, crude petroleum, ilmenite, natural gas, and rare-earth minerals in the Far East.

The oil and gas industry continued to progress with more oil and gas production capacity being added by Esso Production Malaysia Inc. (EPMI) at the Seligi Oilfield offshore of Terengganu. Also there was the launching of the second phase of the gas-utilization project by the state-owned Petroliam Nasional Bhd. (Petronas) to bring offshore natural gas to the industrial and population centers along the west coast of peninsular Malaysia. Following a downward trend in oil and gas exploration during 1982-87, exploration activity was expected to increase in 1988, owing to stabilized world oil prices and better terms in the new production-sharing contracts offered by the Malaysian Government to foreign oil companies in 1986. The Government, through Petronas, signed five new production-sharing contracts and five letters of intent with oil companies from Japan, the Republic of Korea, Taiwan, and the United States for exploration of oil and gas offshore of Sabah, Sarawak, and Terengganu.

The tin industry, still in the process of recovery, reactivated about 30 tin mines, mainly from the gravel-pumping sector, because of a slight improvement in the market price of tin. About 1,000 tin miners rejoined the industry's employment. In early 1987, seven members (including Malaysia) of the Association of Tin Producing Countries (ATPC) agreed to control their tin exports, using a quota system, starting in March and extending for 12 months. In September, the ATPC's tin-export-control agreement was extended beyond 1988 to reduce further the surplus tin stocks. The management of copper mining operations at the Mamut Mine in Sabah was taken over by the Mamut Copper Mining Sdn. Bhd., a new majority-Malaysian-controlled company, from the Overseas Mineral Resources Development Sabah Bhd. (OMRDS) in April. As a result of higher gold prices in 1987, gold output from small-scale mines in the States of Pahang and Sarawak and gold recovered as a byproduct of tin dredging and gravel pumping in the States of Perak and Selangor increased substantially.

In the mineral processing sector, the 3-year-old direct-reduced-iron (DRI) plant, owned and operated by Perwaja Terengganu Sdn. Bhd. (PTSB) at Telok Kalong, near Kemaman in Terengganu, was shut indefinitely in February. The closure resulted from inefficient plant operations and reduced domestic demand for DRI. Nippon Steel Corp., the designer and builder of the DRI plant, paid about $194 million to compensate PTSB for not meeting certain quality specifications of DRI produced by the plant. Production of direct-reduced, hot-briquetted iron (HBI) by Sabah Gas Industries Malaysia Sdn. Bhd. (SGIM), on Labuan Island off Sabah, for export markets was at full capacity.To meet the growing demand for its HBI, SGIM planned to expand its capacity to 870,000 tons per year. Malaysia brought on-stream a new 1.2-million-ton-per-year cement plant at Pedang Rengas in Perak in early 1987. The cement industry, having an installed capacity of 7.2 million tons per year, was operating at less than 50% capacity in 1987 because of a continuing recession in the construction industry. Production of LNG in Bintulu, Sarawak, for export to Japan was at full capacity of 317 billion cubic feet.

According to Malaysia's Ministry of Finance, the output of the mining industry increased only 0.1%, compared with an increase of 7.5% (revised) in 1986. However, the mining industry continued to contribute about 11% to Malaysia's GDP, which was estimated at $27.7 billion ($21.7 billion in 1978 constant dollars). The Malaysian economy was estimated to have grown 1.7%, compared with 2.1% (revised) in 1986. Economic growth in 1987 was sustained principally by a 7.5% increase in the output of the manufacturing sector which contributed 22.2% to Malaysia's GDP in 1987. Malaysia's export earnings were estimated at $16.1 billion and imports at $13.7 billion. The merchandise trade surplus was about $4.7 billion, compared with $3.4 billion in 1986. The inflation rate, as measured by changes in the Consumer Price Index, rose to 1.5% from 0.7% in 1986. The country's labor force increased to 6.3 million, with about 570,000 unemployed in 1987.[3]

A national mining policy was being drafted by the Geological Survey of Malaysia (GSM) and the Department of Mines to ensure that the country's mineral resources are exploited in an orderly and efficient manner to meet the overall objective of developing the nation. According to the Ministry of Primary Industry, the new policy would provide not only the guidelines but also the incentives to attract investment for mineral exploration and development. High priority was given to exploration and development of gold and associated minerals.[4] In an effort to increase State revenues, Perak reportedly would give priority to small-scale mining of gold in Bidor, iron ore in Hulu Perak, and manganese oxide in Sungai Siput.

PRODUCTION

The overall output of the mining industry remained at about the 1986 level. Crude petroleum production dropped to an average of 498,000 barrels per day (bbl/d) from 503,000 bbl/d in 1986, while output of natural gas rose to 1.6 billion cubic feet per day from 1.5 billion (revised) cubic feet per day in 1986. Production of ilmenite and tin, stimulated by improvement in market prices, increased moderately. Mine production of bauxite and iron ore decreased because of reduced demand from foreign markets. Mine production of copper and gold increased as market prices of copper and gold moved upward in the spring of 1987.

Despite the recent downturn in the tin-mining industry, Malaysia remained the world's largest producer. Output of tin reached its lowest level in June 1986, when the market price dropped to $5.62 per kilogram. But the price rose to $6.75 per kilogram in early 1987 and stabilized between $6.50 and $6.70 per kilogram in the second half of 1987. During 1987, about 30 inactive tin mines resumed operations; 23 were from the gravel-pumping sector and 7 were from the open pit mining sector. Extraction of rare-earth minerals, such as monazite and xenotime, columbite, struverite, and zircon from tin tailings increased during 1984-87, owing to increased exports to Japan and Western European countries. Malaysian processing plants for tin tailings reportedly imported considerable amounts of raw materials from Australia and Thailand.

Production of cement dropped to less than 3 million tons because of a further slowdown in the country's construction industry and reduced exports. Production of DRI for domestic consumption by PTSB in Terengganu was stopped in February, while production of DRI for export by SGIM on Labuan Island was at full capacity. Production of crude steel remained stagnant, owing to a weak domestic demand for steel products such as steel wire and bar by the construction industry.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987[p]
METALS					
Aluminum: Bauxite, gross weight thousand tons	502	680	492	559	482
Antimony, mine output, Sb content (Sarawak)	136	17	12	--	129
Columbium and tantalum concentrate, gross weight	67	45	80	215	228
Cb content of columbium[e]	10	7	12	[r]32	34
Ta content of tantalum[e]	7	3	6	[r]15	16
Copper, mine output, Cu content (Sabah)	29,048	28,852	30,507	28,301	29,861
Gold, mine output, Au content:					
Malaya troy ounces	5,792	7,041	7,115	8,839	14,532
Sabah do.	78,543	82,012	78,818	71,396	87,321
Sarawak do.	162	474	4,371	6,791	11,156
Total do.	84,497	89,527	90,304	87,026	113,009
Iron and steel:					
Iron ore and concentrate thousand tons	114	194	182	208	161
Steel, crude do.	350	350	550	750	[e]800
Rare-earth metals: Monazite, gross weight	1,051	4,980	5,808	5,959	2,908
Silver, mine output, Ag content					
Sabah thousand troy ounces	485	470	522	452	497
Sarawak[3] do.	--	--	--	--	10
Tin:					
Mine output, Sn content	41,367	41,307	36,884	29,135	30,388
Metal, smelter	53,338	46,911	45,500	43,788	44,363
Titanium: Ilmenite concentrate, gross weight	[r]222,712	[r]268,490	[r]314,736	414,941	509,202
Tungsten, mine output, W content	31	25	20	[e]25	[e]25
Zirconium: Zircon concentrate, gross weight	2,548	[r]7,993	11,652	12,633	17,828
INDUSTRIAL MINERALS					
Barite	21,434	23,421	23,394	22,506	38,935
Cement, hydraulic thousand tons	3,231	3,469	3,128	3,176	2,922
Clays: Kaolin	57,432	72,472	82,576	85,052	92,882
Nitrogen: N content of ammonia	28,800	38,900	53,400	[r e]300,000	321,300
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural (Sarawak): Gross million cubic feet	150,161	398,700	483,224	525,965	[e]584,000
Petroleum:[4]					
Crude thousand 42-gallon barrels	139,800	163,082	156,950	183,814	181,724
Refinery products:					
Gasoline do.	7,608	8,288	8,745	8,808	[e]9,400
Jet fuel do.	2,618	2,642	[e]2,650	[e]2,700	[e]2,900
Kerosene do.	4,079	4,623	3,461	3,876	[e]3,900
Distillate fuel oil do.	14,062	14,351	11,719	10,293	[e]10,500
Residual fuel oil do.	11,254	11,585	7,543	8,298	[e]8,100
Other[5] do.	3,593	3,929	[r e]11,492	[r e]11,500	[e]12,000
Total do.	43,214	45,418	[e]45,610	[r e]45,475	[e]46,800

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

[1]All production is from Peninsular Malaysia (Malaya) unless otherwise specified. Table includes data available through June 14, 1988.

[2]In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone), fertilizers, and salt are produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.

[3]Byproduct from gold mines in Sarawak.

[4]Includes production from Malaya, Sabah, and Sarawak.

[5]Includes liquefied petroleum gas, lubricants, and naphtha.

TRADE

According to Malaysia's Ministry of Finance, the country's merchandise exports rose to $16.1 billion from $13.7 billion (revised) in 1986, while imports increased to $11.4 billion from $10.3 billion (revised) in 1986. As a result, Malaysia's trade surplus improved to $4.7 billion from $3.4 billion in 1986. The higher export earnings resulted from higher prices for major export commodities such as crude petroleum, forestry products, nonfuel minerals, and rubber.

Export earnings from crude petroleum rose to $2.6 billion from $2.1 billion in 1986, while export earnings from LNG dropped to $681 million from $734 million in 1986. Exports of bauxite, copper concentrate, other nonfuel minerals, and tin were estimated at $460 million. Malaysia exported most of

its crude petroleum to Japan and Singapore. All exports of copper concentrate went to Japan. Tin was exported to Japan, Western Europe and the United States; bauxite and other byproducts of tin, such as ilmenite concentrate and rare-earth minerals, were exported mostly to Japan.

In 1987, Malaysia's merchandise exports to the United States were valued at $3.1 billion, while Malaysia's imports from the United States were valued at $1.8 billion. The U.S. share in Malaysia's total value of two-way merchandise trade rose slightly to 17.8% from 17.6% in 1986. Japan, Singapore, and European Economic Community countries remained important trading partners of Malaysia.

COMMODITY REVIEW

METALS

Copper.—Because of a large accumulated loss from the Mamut copper operations in Sabah resulting from prolonged low prices, increased interest charges on outstanding loans, and a 7% State tax on mine output, the seven Japanese copper smelters participating in the joint-venture project through OMRDS of Japan, officially withdrew from active involvement in management of the mining operations at the end of March 1987. To prevent the mine from closing and to continue receiving copper concentrate from the mine, the seven Japanese smelters (led by Mitsubishi Metal Corp.) agreed to restructure the project's $80 million debt by disclaiming a $47 million debt repayment.

In April, a new majority-Malaysian-controlled company, the Mamut Copper Mining Sdn. Bhd., was established to take over management of the mine. Mitsubishi Metal, Nippon Mining Co. Ltd., and a few other Japanese copper smelters reportedly were still holding a minority interest in the project. In 1987, Japan continued to import about 135,000 tons of copper concentrate, containing 32,000 tons of copper, from the Mamut Mine.

Gold.—Gold production from several small-scale gold mines in the Raub area of Pahang and the Bau area of western Sarawak and as a byproduct of tin dredging and open pit operations in the States of Perak and Selangor reached another record high owing to higher gold prices in 1987. Gold recovered as a byproduct from the Mamut copper mine also increased because of increased copper production.

In September, Dome Resources NL of Australia signed a joint-venture agreement with the State of Kelantan to explore for gold in a 1,500-square-kilometer area identified earlier by the GSM as offering the best prospects of finding viable primary and placer gold deposits. The areas identified by GSM in 1980 included Gua Musang, Manik Urai, Sokor and Dabong, Sungei Pergau, Sungei Kelantan, and Sungei Galas. Dome Resources was also granted three prospecting licenses by the State of Sabah to explore for gold, platinum, and silver in the areas of Umas-Umas, Balambangan Island, and Taritipan.[5]

Iron and Steel.—Direct-reduced HBI produced entirely for export by SGIM on Labuan Island off Sabah was at full capacity. According to a company official, SGIM planned to increase its direct-reduced HBI production capacity by 150,000 to 870,000 tons per year by installing a fourth hot-briquetting machine. SGIM was expected to make a decision on the expansion in 1988. According to the company's earlier marketing efforts, foreign demand for SGIM's direct-reduced HBI reportedly exceeded its 720,000-ton-per-year capacity. The price of direct-reduced HBI remained competitive with that of high-grade steel scrap in 1987.

Production of DRI for the domestic market by PTSB at the Telok Kalong industrial estate in Kemaman, Terengganu, ceased in February. The main reasons for the closure were technical problems related to quality specifications of the briquetted iron produced by the plant; reduced consumption of DRI by domestic steelmakers, resulting from lower prices of steel scrap; and reduced domestic demand for steel. According to PTSB, the DRI-to-scrap ratio of its steel billet plant never exceeded 60:40 compared with the originally planned 80:20 ratio. Some DRI produced earlier reportedly was exported to Nippon Steel of Japan. According to industry sources, inconsistent quality of the natural gas (which sometimes had a high content of unwanted carbon) and prob-

lems related to the quality of ore were partially attributable to inefficient operation of the DRI plant.[6]

In April, Nippon Steel, the DRI plant designer and builder, reportedly paid $194 million to compensate PTSB for failure to resolve the technical problems of meeting the original contract specifications. However, because of higher interest charges on the project's Japanese loans, inefficient operation of the DRI plant, and weak domestic demand for steel products by the construction industry, PTSB suffered a loss of $42 million for fiscal year 1986 (ended in March). To reduce the high-interest costs on a $503 million loan from the Export-Import Bank of Japan, PTSB reportedly obtained a new loan from a consortium of Japanese banks (led by Dai-Ichi Kangyo Bank) to refinance the loan. As a result of the rapid appreciation of the Japanese yen, the effective interest rate on the original loan ballooned to 18.03% from 7.75% in 1987.

Tin.—Production increased moderately as more idled mines were reactivated mainly in the gravel-pumping sector in the States of Perak and Selangor following improvement in the price of tin. The average monthly price of tin on the Kuala Lumpur Tin Market (KLTM) recovered to $6.61 per kilogram in June from $5.81 per kilogram in June 1986. According to Malaysia's Department of Mines, the number of operating mines increased to 225 in September from 195 in September 1986. For the first 9 months, tin mine production rose 5.7% to 23,045 tons from 21,805 tons for the same period in 1986. Of the tin produced in the first 9 months, 41% was by dredging, 39% by gravel pumping, 9% by open pits, and 11% by other methods.

Despite a slight improvement in tin production, the industry was still far from full recovery. It is unlikely to regain its former role in the Malaysian economy in the near future because of continuing depressed tin prices, the decreasing world demand for tin, and increasing tin supplies from low-cost producers, especially Brazil. Export earnings from tin, once contributing $1 billion and accounting for 8% of Malaysia's export earnings in the early 1980's, have dropped to $258 million and contributed only 1.9% to Malaysia's export earnings in 1986. Employment in the tin industry has declined to 12,000 from 39,000 in the early 1980's, while the number of operating mines decreased to about 230 from 850.

Following the October 1985 tin crisis, Malaysia Mining Corp. (MMC), the world's largest tin-mining company, began a major restructuring program. MMC first underwent massive cost-cutting and reorganization by closing high-cost tin mines and laying off workers in 1986. Secondly, it further consolidated and diversified by divesting itself from six satellite tin-mining companies and associates in 1987. According to Malaysian press reports, this divestment was to reduce MMC's debts, to fund various MMC diversification programs in diamonds and precious metals, and to restore company profitability. The six disposed companies and MMC's previous stakes in the companies, respectively, were Aokam Tin Dredging, 42.9%; Ayer Hitaman Tin Dredging, 13.9%; Kampong Lanjut Tin Dredging, 30.0%; Kamunting Tin Dredging, 23.8%; Tongkah Harbor Tin Dredging, 42.0%; and Tronoh Mines Malaysia, 17.5%. These companies reportedly were either inactive or had low tin reserves.

The Sungei Lembing Mine, the largest and deepest underground tin mine in Malaysia (owned and operated by Pahang Investments Public Ltd. Co. (PIPLC)) was to be taken over by MMC for M$1.00 (US$0.40) free of all liabilities in May. However, according to Malaysian press reports, a shareholder of PIPLC filed a winding-up petition against PIPLC in the Kuala Lumpur High Court in March, claiming that several former and current directors of the board were acting in their own interest and that the transaction was fraudulent, oppressive, unfair, and unjust to a majority of the shareholders. As a result, the takeover of the mine by MMC reportedly was postponed while the Government worked on a new formula for MMC to take over the mine and prevent closure. The mine produced 1,000 tons of tin before the October 1985 tin crisis and produced about 450 tons of tin before the mine ran out of money in 1986. To prevent the mine from flooding, 175 maintenance workers had been working without pay since September 1986. According to industry sources, the break-even rate of tin production was estimated at 100 tons per month with a market price of about $6.60 per kilogram.[7] In September, the Government reportedly was also looking for a private company to take over the Sungei Lembing Mine.

The Government's $27 million soft loan program to assist the financially troubled tin miners received a poor response and was available only to small-scale miners begin-

ning in the second half of 1987. Tin miners with production of more than 300,000 cubic meters and capital investment of more than $4 million were disqualified. According to a Government official, since July 1986, 152 miners applied for loans, 64 applications were approved, and 8 applications were withdrawn later. A year after the program was implemented, only $1.1 million was disbursed to seven mining companies.

According to an agreement reached by the seven members of ATPC in January, the members' annual tin exports would be limited to 96,000 tons over a 12-month period (beginning in March 1986) to reduce the 75,000-ton surplus. Thus, Malaysia's export quota was limited to 28,526 tons in 1987. Following the second meeting of ATPC in Kuala Lumpur in September, the seven members agreed to extend export controls beyond February 1988. According to an industry source, by July the tin surplus declined to 59,000 tons and was expected to be reduced to 45,000 tons by yearend.[8]

In May, KLTM opened its trading to Indonesian and Thai tin, but no tin was offered for trading by either country. However, Trans-World Metals Ltd. of the United Kingdom and Thailand Smelting and Refining Co. Ltd. (Thaisarco) of Thailand became members of KLTM in September. On October 27, the Kuala Lumpur Commodity Exchange (KLCE) started the world's only tin futures trading. Trading on the London Metal Exchange was suspended in October 1985. Initially, the tin futures contracts were limited to 300 tons per day for Malaysian tin, and prices were quoted in U.S. dollars. Malaysian Futures Clearing Corp. Sdn. Bhd. guaranteed the financial performance of the tin futures contract traded on KLCE.

Yttrium.—Yttrium was produced by two Malaysian-Japanese joint-venture firms, Malaysian Rare Earth Corp. and Asian Rare Earth (ARE), near Ipoh in Perak, 220 kilometers north of Kuala Lumpur. The two companies used domestic and imported monazite (from Australia and Thailand) to extract yttrium. In the chemical process, a radioactive byproduct, thorium hydroxide, was also produced. Most yttrium produced in Malaysia was exported to Japan for consumption mainly by the television manufacturing industry. The ARE plant was closed in October 1985, because of an order issued by the Ipoh High Court. The closure resulted from a suit filed in March 1985 by residents living near the plant for improper safety measures. The ARE reopened its 4,000-ton-per-year plant in February after receiving a 1-year temporary license from Malaysia's Atomic Energy Licensing Board. The ARE is 35% owned by Mitsubishi Chemical Industries Ltd. of Japan, with capital investments of $ 12 million, 40% by Beh Minerals Sdn. Bhd., 20% by Pilgrim Management Fund Board of Malaysia, and 5% by local individuals. The ARE plant was managed by Mitsubishi Chemical. Because of problems associated with storing radioactive materials and the production suspension, ARE reportedly lost $2.8 million during the 2-year period.[9]

INDUSTRIAL MINERALS

Despite expansion of the industry's production capacity to more than 7 million tons per year, Malaysia's cement production dropped to less than 3 million tons in 1987 because of reduced domestic demand. Domestic cement consumption reached 4.7 million tons in 1984 and declined to 3 million tons in 1986 and 1987, because of a recession in the construction industry. To cope with the problems of excess capacity, the cement industry reportedly was investigating a proposal to reallocate the regional quota among cement plants established to save the costs of handling and transportation. The industry was also considering forming one cement marketing company for better control of cement distribution and cooperating to share costs among cement producers for exporting cement to overseas markets.

Perak Hanjoong Simen Sdn. Bhd. brought on-stream its 1.2-million-ton-per-year cement plant at Pedang Rengas in Perak in early 1987. Table 2 shows the location and capacity of Malaysia's cement producers.

Table 2.—Malaysia: Cement production capacity, 1987

(Thousand metric tons)

Company and location	Annual capacity
Associated Pan Malaysia Cement Sdn. Bhd.:	
Kanthan, Perak	1,000
Rawan, Selangor	1,500
Cement Industries Malaysia Sdn. Bhd.: Kangar, Perlis	1,000
Kedah Cement Sdn. Bhd.: Langkwai, Kedah	1,200
Malaya Industries & Mining Corp.: Batu Caves, Selangor	180
Perak Hanjoong Simen Sdn. Bhd.: Pedang Rengas, Perak	1,200
Tasek Cement Bhd.: Ipoh, Perak	1,100
Total	7,180

Because of low-capacity utilization resulting from the slump in the cement market and high-interest costs on overborrowings, Kedah Cement refinanced 62% of its $200 million construction loans from foreign banks in November. The state-owned Heavy Industries Corp. of Malaysia, which owned 35% of Kedah Cement, reportedly obtained the refinancing package through the Chase Investment Bank of the United States. The new Japanese loans reportedly were in two packages, one for 10 years at 5.95% and the other for 15 years at 6.00%, and were provided by a syndicate led by the Japan Leasing Corp.

MINERAL FUELS

Natural Gas.—Natural gas production from offshore of Sabah, Sarawak, and Terengganu increased to 1.6 billion cubic feet per day from 1.5 (revised) billion cubic feet per day in 1986, resulting from further increases in consumption of natural gas for production of LNG in Bintulu, Sarawak, and production of LPG in Kerteh, Terengganu. More than 80% of the natural gas produced in Malaysia was exported to Japan in the form of LNG. Because of its large natural gas reserves and the strength of natural gas export earning power, Malaysia was looking for long-term export markets in the Republic of Korea, Singapore, and Taiwan.

According to Petronas, the state-owned oil and gas company, the second phase of the gas-utilization project to bring offshore natural gas to Peninsular Malaysia's west coast began in late 1986. The $476 million project for construction of a 726-kilometer pipeline was expected to start in 1988. The pipeline will bring gas from Terengganu on the east coast to Segamat, Johore, from where one branch will connect Johore Bahru in the south and another will continue west and north to the Kelang Valley where the industrial and population centers are located. The project was scheduled for completion in 1990 or 1991. Petronas reportedly has acquired 6,000 acres of land for the pipeline and cleared 80% of the site. Petronas planned to finance the project internally, although Japan's Overseas Economic Cooperation Fund reportedly offered to extend a $397 million, 30-year loan at 4% interest for the project.[10]

In connection with Peninsular Malaysia's pipeline project, Petronas awarded Novacorp of Canada the main project contract for pipeline management, operation, and maintenance in late 1986. Petronas also awarded a consortium, led by United Engineers of Malaysia and Toyo Engineering Corp. of Japan, a management contract in early 1987 for a new gas-processing plant, an LPG export terminal, and a small reticulation system.

According to Malaysia LNG Sdn. Bhd., the operator of the Bintulu LNG plant in Sarawak, the plant earned an accumulated net income of $3.2 billion since production began in January 1983. The annual dividend was 9.5% in the past; however, the company's managing director said shareholders could expect a substantial increase in dividends (20% to 30%) in the future. Malaysia LNG is 60% owned by Petronas; 17.5% by Shell Gas B.V., 17.5% by Mitsubishi Corp. and 5% by the Sarawak State government. In 1986, exports of LNG totaled 278.5 billion cubic feet and were valued at more than $734 million. According to the Ministry of Primary Industry, export earnings from LNG were estimated at $681 million in 1987.

Petroleum.—In supporting OPEC's plan to stabilize world oil prices, the Government of Malaysia cut its crude petroleum production for 6 months by 10% from the originally planned 520,000-barrel-per-day level for 1987. As a result, the output of crude petroleum decreased to an average of 498,000 barrels per day in 1987 from 503,000 barrels per day in 1986. However, the Government announced in November that the output of crude petroleum would be raised to 540,000 barrels per day in 1988 to increase revenues and export earnings. According to the Ministry of Primary Industry, export earnings from crude petroleum were valued at $2.1 billion in 1986 and were expected to increase to $2.6 billion in 1987. Two oil platforms and a central-processing facility at the newly developed Seligi Oilfield offshore of Dungun, Terengganu, reportedly were expected to be installed and commence production in 1988. The oilfield, being developed by EPMI, has oil reserves of 1 billion barrels.

Because of stabilized world oil prices, higher incentives provided by better production-sharing contract terms, and the high potential for discovering oil and gas in Malaysia, exploration activity was expected to increase substantially in 1988. In 1987, five production-sharing contracts were signed between Petronas and the following foreign oil companies: a consortium of Idemitsu Oil Development Co. Ltd. of Japan and

Pecten Sarawak Co. of the United States for Block SK1 off Sarawak; a consortium of Overseas Petroleum & Investment Corp. of Taiwan, Phoenix Resource Co. of the United States, and Samsung Co. and Yukong Ltd. of the Republic of Korea for Block SK7 off Sarawak; AOC Energy Development Co. Ltd. of Japan for Block SK14 off Sarawak; a consortium of Taiyo Oil Development Co. and Japan Petroleum Exploration Ltd. of Japan and Petronas Carigali Sdn. Bhd. of Malaysia for Block PM10 off Terengganu; and a consortium of Sabah Shell Petroleum Co. and Pecten Malaysia Co. of the United Sates for Block SB1 off Sabah. Petronas also signed five letters of intent with foreign oil companies mainly from the United States.[11]

According to both Petronas and Government data, Petronas and its contractors were expected to spend $93.7 million and drill 14 exploratory wells in 1987, compared with 15 (revised) in 1986 and 29 (revised) in 1985.

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[1]Economist, Division of International Minerals.

[2]Where necessary, values have been converted from Malaysia ringgits (M$) to U.S. dollars at the rates of M$2.58=US$1.00 in 1986 and M$2.52=US$1.00 in 1987.

[3]U.S. Embassy, Kuala Lumpur, Malaysia. Economic Trends Report. State Dep. Airgram A-31, Nov. 12, 1987.

[4]The Star (Penang). Jan. 15, 1987, p. 1.

[5]Mining Journal (London). V. 309, No. 7934, Sept. 11, 1987, p. 200.

[6]The Asian Wall Street Journal. V. 11, No. 159, Apr. 16, 1987, p. 1.

Far Eastern Economic Review (Hong Kong). V. 136, No. 18, Apr. 30, 1987, p. 54.

[7]Tin International (Kuala Lumpur). V. 60, No. 8, Aug. 1987, p. 168.

Far Eastern Economic Review (Hong Kong). V. 136, No. 73, Jun. 1987, p. 68.

[8]Mining Journal (London). V. 309, No. 7937, Oct. 2, 1987, p. 261.

[9]The Asian Wall Street Journal. V. 11, No. 183, May 21, 1987, p. 1.

Far Eastern Economic Review (Hong Kong). V. 136, No. 21, May 21, 1987, p. 49.

[10]U.S. Embassy, Kuala Lumpur, Malaysia. State Dep. Telegram 09089, Nov. 3, 1987, p. 1.

[11]Petroleum News (Hong Kong). V. 18, No. 8, Nov. 1987, p. 39.

The Mineral Industry of Malta

By E. Shekarchi[1]

Malta's production of lime, limestone, and salt in 1987 remained at the same levels as in previous years. All of these products were consumed in the local construction industry, and Malta was obliged to import all of its metal and fuel commodities and industrial minerals.

The election results of May 1987 produced the most significant change in Malta's political scene since the island became a republic in 1974. The Socialists were voted out after 13 years of uninterrupted power, and the Nationalists took control. The Nationalists inherited a country dominated economically by the state, which controlled all utilities, the banks, shipyards, and telecommunications. The Government was the leading employer with 46% of the working population on its payroll.

The Nationalist government assumed a positive attitude toward private and foreign investment, with the intention of gaining new technology and managerial skills that were in short supply in Malta. It welcomed ventures in aviation, information handling systems, light engineering, and optical equipment. Prospective foreign investors were offered a number of incentives, such as government-leased factories at concessional rates, tax exemptions for imported capital equipment and raw materials, tax reduction on reinvested profits and accelerated depreciation allowances. Also, the Government offered foreign oil companies a number of offshore areas through oil-production-sharing contracts. These areas were in addition to the oil concessions previously awarded south of Malta, where drilling had been suspended as a result of a median-line dispute with Libya.

Although tourism remained a substantial source of foreign exchange in 1987, earning about $370 million,[2] Malta's two largest Government-owned companies, Malta Drydocks Co. and Malta Shipbuilding Co. continued to counter the worldwide recession in ship-repair work by diversifying into new shipbuilding, renovation of passenger liners, and industrial steelwork. The total income of the two shipbuilding companies contributed more than $70 million in 1987.

[1]Supervisory physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Maltese lira (ML) to U.S. dollars at the rate of ML2.55=US$1.00 for 1987.

Table 1.—Malta: Estimated production of mineral commodities[1]

Commodity		1983[2]	1984[2]	1985	1986	1987
Lime	cubic meters	5,080	5,474	5,500	5,500	5,500
Limestone	thousand cubic meters	808	652	700	650	600
Salt	metric tons	150	92	100	100	100

[1]Table includes data available through May 15, 1988.

[2]Reported figure.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destination, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Scrap	177	293	--	All to Italy.
Semimanufactures				
value, thousands	$34	$1,659	$60	Italy $1,597; West Germany $1.
Copper: Metal including alloys:				
Scrap	278	170	--	Italy 64; Netherlands 50; West Germany 37.
Semimanufactures				
value, thousands	--	$2	(2)	Mainly to Italy.
Iron and steel: Metal:				
Scrap	11,798	5,427	--	Italy 3,978; Spain 1,074; Netherlands 109.
Steel, primary forms	--	2	--	All to West Germany.
Semimanufactures:				
Wire value, thousands	$2	$16	--	All to Italy.
Tubes, pipes, fittings do	$4	$83	--	Italy $82.
Castings and forgings, rough do	r$302	$745	--	Belgium-Luxembourg $556; Algeria $189.
Lead: Metal including alloys:				
Scrap	189	739	--	Italy 561; West Germany 118; United Kingdom 60.
Semimanufactures				
value, thousands	(2)	--		
Nickel: Metal including alloys:				
Scrap	3	7	--	United Kingdom 4; West Germany 3.
Semimanufactures				
value, thousands	--	$2	--	All to West Germany.
Silver:				
Waste and sweepings do	$2	--		
Metal including alloys, unwrought and partly wrought do	$2	--		
Tin: Metal including alloys, semimanufactures do	--	$1	--	Mainly to Syria.
Zinc: Metal including alloys:				
Scrap	68	61	--	West Germany 33; Italy 15; United Kingdom 13.
Semimanufactures				
value, thousands	$1	(2)	--	All for ship stores.
Other: Ashes and residues	--	19	--	All to United Kingdom.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Dust and powder of precious and semiprecious stones including diamond value, thousands	$18	--		
Grinding and polishing wheels and stones do	$144	$696	--	Australia $325; Yugoslavia $170; West Germany $154.
Diamond: Gem, not set or strung do	$764	$3,392	--	All to Belgium-Luxembourg.
Fertilizer materials: Crude, n.e.s	207	70	--	All to Italy.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked value, thousands	--	$14	--	Do.
Worked do	$2	$9	--	United Kingdom $6; Italy $2; Belgium-Luxembourg $1.
Sulfur: Sulfuric acid do	(2)	--		
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Lubricants 42-gallon barrels	2,862	1,531	--	West Germany 1; bunkers 1,530.
Residual fuel oil do	64,230	--		
Bitumen and other residues do	--	88	--	All to Italy.

rRevised.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides value, thousands	$4	$19	(2)	Switzerland $9; Italy $5; France $4.
Metal including alloys:				
Scrap	--	1	--	All from West Germany.
Unwrought value, thousands	(2)	$521	(2)	Italy $334; United Kingdom $139; Netherlands $45.
Semimanufactures do	$1,032	$7,487	$74	Italy $5,699; United Kingdom $664; West Germany $266.
Arsenic: Metal including alloys, all forms do	--	$1	--	All from Sweden.
Beryllium: Metal including alloys, all forms do	(2)	--		
Chromium: Oxides and hydroxides do	(2)	$16	--	United Kingdom $13; West Germany $3.
Cobalt: Oxides and hydroxides do	(2)	--		
Columbium and tantalum: Metal including alloys, all forms, tantalum do	(2)	--		
Copper: Metal including alloys:				
Unwrought	1	15	--	United Kingdom 14.
Semimanufactures value, thousands	$233	$1,478	$3	United Kingdom $752; France $263; Italy $223.
Iron and steel:				
Iron ore and concentrate, pyrite, roasted	8	6	--	All from Yugoslavia.
Metal:				
Scrap	--	529	--	Netherlands 527; West Germany 2.
Pig iron, cast iron, related materials[3]	7,818	7,631	--	Greece 7,135; Canada 320; Czechoslovakia 133.
Ferroalloys:				
Ferromanganese	--	1	--	All from United Kingdom.
Unspecified	20	48	--	Do.
Steel, primary forms	6,044	6,342	--	United Kingdom 1,849; Spain 1,781; Italy 1,476.
Semimanufactures:				
Bars, rods, angles, shapes, sections value, thousands	$853	$7,131	$2	United Kingdom $2,607; Belgium-Luxembourg $2,151; West Germany $972.
Universals, plates, sheets do	$1,706	$7,988	(2)	Romania $2,119; West Germany $1,981; Czechoslovakia $1,168.
Hoop and strip do	$46	$235	--	Italy $149; West Germany $64; United Kingdom $11.
Rails and accessories do	$19	$8	--	Netherlands $7; Belgium-Luxembourg $1.
Wire do	$217	$998	(2)	Italy $456; United Kingdom $137; Poland $135.
Tubes, pipes, fittings do	$727	$5,204	$3	United Kingdom $1,845; Belgium-Luxembourg $1,225; Italy $854.
Castings, and forgings, rough do	$5	(2)	--	All from United Kingdom.
Lead:				
Oxides do	$19	$60	--	United Kingdom $32; West Germany $28.
Metal including alloys:				
Unwrought	191	194	--	United Kingdom 193; Italy 1.
Semimanufactures value, thousands	$8	$27	--	United Kingdom $10; Italy $9; Japan $4.
Magnesium: Metal including alloys:				
Scrap	--	200	--	All from West Germany.
Unwrought	--	100	--	All from United Kingdom.
Semimanufactures value, thousands	(2)	$2	(2)	Mainly from West Germany.
Manganese: Oxides do	--	$2	--	Mainly from Japan.
Mercury do	(2)	(2)	--	Mainly from United Kingdom.
Nickel: Metal including alloys:				
Unwrought	8	3	--	All from United Kingdom.
Semimanufactures value, thousands	$45	$246	--	West Germany $131; United Kingdom $112; Greece $2.
Platinum-group metals: Metals including alloys, unwrought and partly wrought do	--	(2)	--	All from West Germany.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Silver:				
Waste and sweepings value, thousands	(2)	$2	--	All from United Kingdom.
Metal including alloys, unwrought and partly wrought ---do---	26,726	51,635	--	United Kingdom 31,082; West Germany 20,360.
Tin:				
Oxides ---do---	(2)	--		
Metal including alloys:				
Unwrought	(2)	6	--	All from Italy.
Semimanufactures value, thousands	$179	$1,300	--	United Kingdom $841; Italy $337; France $65.
Titanium: Oxides ---do---	$108	$521	$166	United Kingdom $243; West Germany $103.
Uranium and/or thorium: Metal including alloys, all forms ---do---	(2)	--		
Zinc:				
Oxides ---do---	$10	$45	--	Netherlands $29; United Kingdom $6. West Germany $5.
Blue powder	2	--		
Metal including alloys:				
Scrap	(2)	1	--	All from Netherlands.
Unwrought	134	145	--	France 90; Belgium-Luxembourg 38; Netherlands 17.
Semimanufactures value, thousands	$10	$84	--	Belgium-Luxembourg $37; Netherlands $20; United Kingdom $10.
Other:				
Ores and conentrates	2	--		
Base metals including alloys, all forms	(2)	(2)	--	Mainly from West Germany.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc value, thousands	$20	$96	--	Italy $54; Greece $18; West Germany $17.
Artificial: Corundum ---do---	$12	$28	(2)	Yugoslavia $26; Italy $1; United Kingdom $1.
Dust and powder of precious and semiprecious stones including diamond ---do---	$18	$13	--	Belgium-Luxembourg $9; Ghana $3; United Kingdom $1.
Grinding and polishing wheels and stones ---do---	$95	$531	$3	Italy $202; Yugoslavia $168; West Germany $78.
Asbestos, crude ---do---	(2)	--		
Barite and witherite ---do---	$2	$59	--	United Kingdom $58.
Boron materials:				
Crude natural borates ---do---	--	(2)	--	All from Italy.
Oxides and acids ---do---	$1	$3	--	West Germany $1; Italy $1; United Kingdom $1.
Cement	187,255	162,840	--	Turkey 79,384; U.S.S.R. 44,810; Bulgaria 30,190.
Chalk value, thousands	$11	$56	--	United Kingdom $27; France $14; Italy $5.
Clays, crude	525	406	--	United Kingdom 332; Italy 74.
Cryolite and chiolite value, thousands	$3	$2	--	Mainly from Yugoslavia.
Diamond:				
Gem, not set or strung ---do---	$705	$4,242	--	Ghana $1,506; Angola $1,214; Belgium-Luxembourg $650.
Industrial stones ---do---	$21	$331	--	Ghana $325; Belgium-Luxembourg $6.
Diatomite and other infusorial earth ---do---	$5	$32	--	Italy $15; West Germany $7; United Kingdom $7.
Fluorspar ---do---	(2)	(2)	--	All from Norway.
Fertilizer materials:				
Crude, n.e.s	--	2,907	--	Italy 2,906; Netherlands 1.
Manufactured:				
Ammonia value, thousands	$5	$20	--	United Kingdom $8; West Germany $6; France $4.
Nitrogenous ---do---	2,113	2,032	--	Italy 1,367; Romania 200; West Germany 100.
Phosphatic ---do---	55	15	--	West Germany 14.
Potassic ---do---	4	--		
Unspecified and mixed ---do---	639	415	2	West Germany 223; Belgium-Luxembourg 140; United Kingdom 41.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Graphite, natural	--	(2)	--	All from Italy.
Gypsum and plaster value, thousands	$10	$38	--	Spain $27; West Germany $8; Italy $2.
Lime	--	5	--	Mainly from United Kingdom.
Magnesium compounds value, thousands	$1	$1	--	Do.
Mica:				
Crude including splittings and waste do	$1	$9	--	United Kingdom $8.
Worked including agglomerated do	(2)	$1	--	Mainly from United Kingdom.
Nitrates, crude do	(2)	--		
Pigments, mineral:				
Natural, crude do	$1	$11	--	All from United Kingdom.
Iron oxides and hydroxides, processed do	$3	$26	--	United Kingdom $17; West Germany $5; Spain $2.
Precious and semiprecious stones other than diamond:				
Natural do	$25	$8	--	West Germany $2; Taiwan $1; Thailand $1.
Synthetic do	(2)	$3	--	West Germany $2.
Salt and brine do	$27	$277	--	United Kingdom $219; Italy $51; West Germany $4.
Sodium compounds, n.e.s.: Carbonate, manufactured	18	140	--	Mainly from Turkey.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked value, thousands	$248	$1,914	--	Italy $1,889; Portugal $13; Belgium-Luxembourg $12.
Worked do	$3	$28	--	Italy $25; India $2.
Gravel and crushed rock do	$117	$828	(2)	Italy $816; United Kingdom $7; Sweden $4.
Quartz and quartzite do	$3	$21	--	United Kingdom $8; Italy $7; Belgium-Luxembourg $4.
Sand other than metal-bearing	1,546	[3]1,270	--	United Kingdom 1,063; Belgium-Luxembourg 180; Italy 21.
Sulfur:				
Elemental:				
Crude including native and by-product	60	--		
Colloidal, precipitated, sublimed	45	93	--	Italy 91; United Kingdom 2.
Dioxide value, thousands	(2)	$4	--	United Kingdom $2; Italy $1.
Sulfuric acid do	$9	$114	--	Italy $49; Netherlands $45; United Kingdom $10.
Talc, steatite, soapstone, pyrophyllite do	$8	$61	$4	Italy $37; Norway $9; United Kingdom $7.
Other: Crude do	$3	$6	--	United Kingdom $4; Austria $1.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	4	2	2	
Carbon:				
Carbon black value, thousands	$58	$286	$14	Italy $126; West Germany $91; Canada $43.
Gas carbon do	--	$9	--	All from United Kingdom.
Coal:				
Anthracite and bituminous	212,081	184,235	--	West Germany 93,640; Italy 37,267; Spain 34,021.
Briquets of anthracite and bituminous coal	9	19	--	Australia 16; Italy 3.
Lignite including briquets	--	1	--	All from United Kingdom.
Coke and semicoke	--	31	--	United Kingdom 16; Italy 15.
Peat including briquets and litter	292	262	--	Ireland 105; United Kingdom 94; Netherlands 63.
Petroleum refinery products:				
Mineral jelly and wax[3] 42-gallon barrels	2,404	2,867	19	Hungary 2,392; West Germany 968; United Kingdom 345.
Lubricants[3] do	23,687	23,478	37	Italy 9,197; Belgium-Luxembourg 7,210; United Kingdom 6,397.
Bitumen and other residues do	25,379	38,872	--	Spain 38,849; United Kingdom 14; Netherlands 9.
Bituminous mixtures value, thousands	$26	$240	--	Spain $154; United Kingdom $50; France $18.

[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]Totals are incomplete owing to unreported quantities.

The Mineral Industry of Mauritania

By Thomas O. Glover[1]

Mauritania's economy was supported chiefly by the mining and fishing industries. Prior to 1983, iron ore exports were the major earner of foreign exchange. Since 1983, the major foreign exchange earner has been the fishing industry. Iron ore sales in 1987 provided only 40% of the foreign exchange earnings with 60% coming from the fishing industry. Export earnings were slightly more than $350 million during the year.[2] In 1981, when iron ore shipments accounted for approximately 80% of total foreign exchange earnings, the total export earnings were slightly less than $200 million. Iron ore exports have been a major source of foreign exchange since the first full year of shipments in 1964. The parastatal mining company, Société Nationale Industrielle et Minière (SNIM) has owned and operated all the iron ore mines in Mauritania beginning in 1971.

Mauritania's recent economic performance has suffered from adverse climatic conditions affecting the agricultural and livestock industry, from the collapse of iron ore and copper prices, and from rising energy costs. The country was burdened with a $1.6 billion debt, an unsustainable balance of payments, and operating dificits. An agreement on rescheduling debts with foreign countries was concluded in July 1987. Under the agreement, 65.7% of the payments falling due between April 1987 and May 1988 will be paid over a 15-year period after a 4-year moratorium. The debts, including principal and interest, amounted to $60 million.

Mauritania's new deepwater port at Nouakchott, constructed by China and inaugurated on September 17, 1986, was not in service late in 1987. The $150 million port, upon which construction was begun in 1980, would enable Mauritania to import all its requirements through the facility. Mauritania has used Senegalese ports for up to 40% of its imports in the past. The new port has a capacity of 500,000 tons per year and allows for future expansion.

PRODUCTION AND TRADE

Production of iron ore in 1987 increased 12% over the 1986 production of 8.9 million tons. Exports of iron ore in 1987 increased slightly over that exported in 1986. Sales of iron ore to Western Europe accounted for 92.8% of all iron ore exports. The Western European nations included Belgium, France, the Federal Republic of Germany, Italy, Portugal, Spain, and the United Kingdom. The remaining exports went to Pakistan and the United States. At the port of Nouadhibou on the Atlantic Ocean, the total 1987 shipments of 9.0 million tons were loaded into 119 cargo vessels for export. The total quantity consisted of 7.9 million tons from the Kedia d'Idjil deposit plus 1.1 million tons of high-grade iron ore concentrates produced from the Guelbs deposit. All the export iron ore was shipped 650 kilometers by rail to the Nouadhibou port. The United States received its first shipment of Mauritanian iron ore in 1986. SNIM contracted with Bethlehem Steel to supply the steel company with 650,000 tons of iron ore in 1987. SNIM supplied 92% of the contracted amount during the year.

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

Commodity[2]	1983	1984	1985	1986[p]	1987[p]
Gypsum ____ metric tons__	[e]4,000	800	5,470	18,060	20,000
Iron and steel:					
Iron ore:					
Gross weight[3] __ thousand metric tons__	7,385	9,527	9,333	8,929	9,000
Iron content[e] ____ do____	4,250	5,754	5,600	5,804	6,100
Metal: Semimanufactures ____ metric tons__	5,454	898	4,481	2,160	10,660

[e]Estimated. [p]Preliminary.
[1]Table includes data available through Aug. 27, 1988.
[2]In addition to the commodities listed, modest quantities of unlisted varieties of crude construction materials (clays, sand and gravel, and stone) and salt presumably are produced, but output is not reported quantitatively, and available information is inadequate to make reliable estimates of output levels.
[3]Reported iron ore exports.

COMMODITY REVIEW

METALS

Copper.—Mauritania's Société Arabe Minière D'Inchiri (SAMIN) had elaborate plans to rehabilitate the copper industry in Akjoujt, Mauritania. The rehabilitation program, involving a group of international backers, met with major financial difficulties which caused the program to be indefinitely postponed. SAMIN planned to extract gold from mine tailings in 1988 that were left from previously mined copper ore in the Akjoujt area. A relatively high return was expected in processing the tailings owing to a low investment in extracting equipment. If the mining of copper becomes financially achievable in the future, the Government would consider reopening the Akjoujt Mine.

Iron Ore.—SNIM continued its $92 million restructuring program during the year by cutting back its labor force by more than 1,000 people by April 1987. It was also able to reduce other operational and management costs. In addition the company invested in new equipment and staff training to raise productivity.

SNIM's original mines, in the Kedia d'Idjill deposit, produced ore at 65% iron content. The ore reserves from this deposit were being depleted rapidly. Reserves at the four existing mines in the Kedia d'Idjill F'Derik, Rouessa, Segazou, and Tazadit, were estimated to be 58 million tons, sufficient to maintain production into the mid-1990's. Earlier forecasts had production ceasing in this area by 1990. The additional time of 5 years gave Mauritania more time to repay loans incurred on the first phase of the Guelbs project as well as to correct problems at the new beneficiation plant at the new El Rhein Mine.

The Guelbs are a series of black magnetitic quartzite hills scattered over the desert plains of northern Mauritania. The eastern Guelbs group consists of one operational mine, El Rhein, and two proposed mines, Oum Arwagen and Marizet. The three mines contain approximately 500 million tons of reserves with an average iron content of 37%. The El Rhein Mine began operating in July 1984 and was a conventional open pit mining operation. Total reserves at the El Rhein Mine were 285 million tons. Mining equipment at the mine included four 14-cubic-yard electric shovels and fourteen 100-ton dump trucks. The mined area contained large-grained magnetite iron ore that was enriched through a magnetic separation process. The ore beneficiation plant utilized an entirely dry enrichment process owing to an acute water shortage. Since startup, the beneficiation plant has operated below capacity owing to various operational problems. Problems with the phase 1 plant, combined with continued depressed world demand and an upward revision of iron ore reserves in the Kedia d'Idjill Mines, mean that phase 2 development could be delayed by several years.

Phase 2 involved opening a new mine at Oum Arwagen and the construction of a new 9-million-ton-per-year beneficiation plant beginning in 1990. Reserves at Oum Arwagen were estimated to contain 101 million tons. The reserves at El Rhein and Oum Arwagen were sufficient to guarantee the output of high-quality iron ore concentrates for marketing as sinter feed.

In annual negotiations with its customers in March 1987, SNIM was forced to accept a 10% price cut. As a result, iron ore prices were dropped below 1975 prices in real

terms. The sharp fall of the value of the U.S. dollar also reduced sales revenue.

An iron bar plant in Nouadhibou, formerly owned by SNIM, has become a joint venture, with several Arab countries providing capital. The plant has been troubled with technical and economic problems since its startup in 1977, having been shut down in 1984 and reopened in 1985. The plant produced iron bars for construction in 1987 but remained hampered with technical problems.

INDUSTRIAL MINERALS

Gypsum.—Gypsum mining north of Nouakchott continued to supply local markets. The rehabilitation program, which included an increased production and startup of exports, got off to a slow start in 1987. A new plaster factory, completed in 1984 to utilize Mauritania's gypsum, had not begun production. However, plaster production rose to 14,000 tons in 1987.

Phosphate.—Exploration of phosphate deposits near Bofal-Loubboira in the Senegal River area continued. Although the deposits of phosphate were quite large, given the high infrastructure costs and low world prices, the prospects were very limited.

MINERAL FUELS

Liquified Petroleum Gas.—The Société Minièra de Gog joint-venture company was delegated to manage and operate a new butane bottling plant in Nouakchott on April 26, 1987. The plant was owned by the Government of Mauritania (34%), the Government of Algeria (33%), and private Mauritanian investors (33%). Production was planned to commence in August 1987 at an annual rate of 4,000 tons. Production capacity is estimated at 5,000 tons per year. Somagaz purchased butane from a Netherlands company, Vanoil. Butane was not purchased from the Nouadhibou refinery owing to high costs. The plant will end Mauritania's dependence on Senegal for butane.

Petroleum.—*Exploration.*—Amoco Mauritania Exploration Co., a subsidiary of Amoco Production Co., has signed a production-sharing contract for offshore petroleum exploration with Mauritania. The agreement covered about 2.6 million acres west of the capital city of Nouakchott, which is on the Atlantic coast. Seismic acquisition began in late 1987 with exploration activities continuing into 1988.

Refining.—The refurbished Nouadhibou refinery was reopened on April 26, 1987. The refinery, which had been built in 1978 to process Algerian oil, had been closed since June 1983. The $30 million renovation, funded by Algeria, was done by Algeria's state-owned Entreprise Nationale d'Engineering Petrolier. Work included building two 720-cubic-meter-per-day desalinization units and a gas plant to recover propane, altering loading facilities, and installing a multiproduct pipeline to supply neighboring SNIM.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Mauritanian ouguiya (UM) to U.S. dollars at the rate of UM72.0 = US$1.00.

The Mineral Industry of Mexico

By Jerome F. Machamer[1]

Mexico's mineral industry staged a significant recovery in 1987, despite inflation of about 60%, concern over the repayment of foreign debt, and the rising cost of spare parts and other imported supplies. The improvement was due to increased production of several major mineral commodities and to generally improved world price levels compared with those of 1986. Sales volume for Petróleos Mexicanos (PEMEX) increased by approximately $2 billion or 19% more than that of 1986, while the value of silver produced rose by about $140 million or 35% compared with that of 1986. The gross domestic product increased by 1.4% in real terms during the year, while overall growth in the mining sector was 3.8%.

Mexico was the world's fifth largest producer of petroleum, after the Soviet Union, the United States, Saudi Arabia, and China; petroleum production increased slightly in 1987. Petroleum reserves, however, declined slightly, reflecting the decrease in exploration activity, which was a result of the reduced oil prices of earlier years. Mexico continued to be the world's largest producer and exporter of silver, which was the country's second most important mineral product. Mexico was also the world's leading producer of fluorspar and was a major producer of antimony, arsenic, barite, bismuth, celestite, graphite, lead, mercury, molybdenum, sodium sulfate, sulfur, and zinc.

Important governmental actions taken during the year include the Economic Solidarity Pact, an agreement between Government, business, labor unions, and rural workers, under which the minimum wage would be tied to increases in the price of a group of basic commodities. At the same time, prices of several Government-produced or provided goods and services, including petroleum products and electricity, were sharply increased. The objectives were to stabilize the general economy and to reduce inflation. Royalties (derechos de minería) were reduced for small and medium miners. An important development for the future was the announcement late in the year of plans to sell or otherwise dispose of Government interest in about 50 state-owned companies, including several medium and large mining companies.

PRODUCTION

Within the mineral fuels category, production of crude oil, natural gas, and run-of-mine coal all increased. Production of steam coal increased, while production of washed metallurgical coal and coke apparently decreased. Production of refinery products increased. Mexico was essentially self-sufficient in regard to energy minerals and derived products.

In the metallic minerals sector, there were significant increases in the production of copper ores and smelter and refinery products, reflecting the basic changes in the country's copper economy that were occurring with the startup of the new smelter of Mexicana de Cobre S.A. Aluminum, cadmium, and zinc output rose, while production of mined and refined lead declined. Silver production rose to a recent new high; gold production increased, although not to the record-high level achieved in 1984. Production of crude and finished steel and of ferroalloys reached new highs, while production of manganese ore declined.

In the industrial minerals area, production of barite, cement, gypsum, magnesia, salt, sodium sulfate, strontium minerals, and sulfur all rose, while production of clays, fluorspar, and phosphate rock declined.

Employment in the mineral industries rose 2% to 225,000. With a reported dependency factor of 5.5, approximately 1.24 million people (1.5%) depend upon the mineral industry for employment.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987[p]
METALS					
Aluminum:					
Primary	39,706	43,988	42,744	39,946	63,260
Secondary	15,122	19,636	22,078	13,925	8,765
Antimony:					
Mine output, Sb content[3]	2,519	3,064	4,266	3,337	2,839
Metal (in mixed bars and refined)	1,782	1,907	2,694	1,955	1,602
Arsenic:[4]					
White	3,395	4,067	3,918	4,030	4,545
Impure	57	97	864	1,285	759
Bismuth[5]	545	433	925	749	1,012
Cadmium:					
Mine output, Cd content	1,341	1,135	1,140	1,133	1,249
Metal, refined	847	838	905	1,016	935
Copper:[6]					
Mine output, Cu content	r198,928	r185,210	r172,897	184,618	247,592
Metal:					
Blister (primary only)	r59,543	r70,339	r68,182	74,662	127,576
Refined:					
Primary	r83,490	r92,163	r123,565	89,494	130,039
Secondary[e]	15,000	13,900	14,000	r7,060	NA
Total[e]	r98,490	r106,063	r137,565	r96,554	130,039
Gold:					
Mine output, Au content ____ troy ounces	198,179	271,001	265,696	230,972	256,822
Metal, refined ____ do	177,504	177,118	198,723	189,207	205,507
Iron and steel:					
Iron ore, mine output:					
Gross weight[7] ____ thousand tons	8,040	8,317	7,820	7,298	7,523
Fe content ____ do	5,306	5,489	5,161	4,817	4,965
Metal:					
Pig iron ____ do	3,537	3,926	3,595	3,724	3,698
Sponge iron ____ do	1,497	1,448	1,500	1,325	1,540
Total ____ do	5,034	5,374	5,095	5,049	5,238
Ferroalloys:					
Ferromanganese ____ do	140	160	154	156	161
Silicomanganese ____ do	42	42	39	61	80
Ferrosilicon ____ do	24	23	28	18	18
Ferrochromium ____ do	3	7	6	3	6
Other ____ do	1	2	3	1	1
Total ____ do	210	234	230	239	266
Steel, crude ____ do	6,978	7,560	7,367	7,170	7,571
Rolled products ____ do	5,473	6,025	r6,042	5,623	5,791
Forgings and castings	68	59	56	26	40
Lead:					
Mine output, Pb content	184,261	202,561	197,489	195,449	177,161
Metal:					
Smelter:					
Primary	r166,550	r174,697	203,036	181,989	176,986
Secondary (refined)[e]	31,000	30,000	31,000	33,000	35,000
Total[e]	r197,550	r204,697	234,036	214,989	211,986
Refined:					
Primary (including lead content of antimonial lead)	162,461	163,205	193,525	178,860	173,830
Secondary[e]	31,000	30,000	31,000	33,000	35,000
Total	193,461	193,205	224,525	211,860	e208,830

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987[p]
METALS —Continued					
Manganese ore:					
Mn content	133,004	180,940	150,647	174,416	146,407
Gross weight, metallurgical ore[8]	r286,600	r431,300	r337,400	394,300	336,000
Gross weight, battery grade ore[e]	16,000	19,000	22,200	38,700	41,300
Mercury, mine output, Hg content 76-pound flasks	6,411	r11,139	r11,429	5,366	3,597
Molybdenum, mine output, Mo content	5,866	4,054	3,761	3,286	4,319
Selenium, mine output, Se content	24	44	42	23	29
Silver:					
Mine output, Ag content thousand troy ounces	63,607	75,340	73,167	77,753	e77,643
Metallurgical products, Ag content do	58,545	60,022	66,061	71,670	75,651
Metal, regined, primary do	53,487	53,023	61,651	62,261	68,876
Tin:					
Mine output, Sn content	334	416	380	585	369
Metal, smelter, primary	1,216	1,531	1,492	1,474	1,723
Tungsten, mine output, W content	186	274	282	294	213
Zinc:					
Mine output, Zn content	266,292	303,573	291,938	278,065	271,480
Metal, smelter, primary	174,991	167,034	175,353	173,700	--
Metal, refined, primary	171,390	162,912	171,388	172,489	184,755
INDUSTRIAL MINERALS					
Abrasives, natural[9]	r191	r609	r248	1,458	12,390
Barite	357,043	426,095	467,693	321,186	401,336
Cement, hydraulic thousand tons	17,068	18,436	20,680	19,751	22,347
Clays:					
Bentonite	226,140	267,348	267,695	136,478	129,596
Common clay	213,775	212,758	254,606	248,351	178,347
Fuller's earth	41,574	45,697	58,000	52,200	49,112
Kaolin	162,000	130,296	282,337	276,427	151,104
Diatomite[10]	43,967	44,634	45,781	36,022	34,708
Feldspar[10]	117,518	r395,036	r432,031	85,019	106,490
Fluorspar:[11]					
Acid-grade thousand tons					291
Ceramic-grade do	NA	NA	NA	NA	--
Metallurgical-grade do					244
Submetallurgical-grade do					189
Total do	r557	r627	r697	757	724
Graphite, natural:					
Amorphous	42,669	39,846	33,468	36,018	36,674
Crystalline	1,658	1,683	1,910	1,838	1,787
Gypsum and anhydrite, crude (yeso)	2,958,085	r4,260,022	r4,602,796	4,232,805	4,575,416
Lime, hydrated and quicklime[e] thousand tons	3,630	4,000	r5,545	4,400	4,400
Magnesium compounds:					
Magnesia[12]	66,300	105,701	121,698	99,965	118,332
Magnesite	23,187	30,424	19,299	e7,530	7,351
Mica, all grades[10]	1,560	1,676	1,446	1,748	3,419
Nitrogen: N content of ammonia	1,935,500	1,772,610	1,858,778	[13]1,652,051	[13]1,794,344
Perlite[10]	41,377	31,515	37,261	46,170	39,428
Phosphate rock[10 14]	785,038	r652,651	r786,500	746,863	688,973
Salt, all types thousand tons	5,703	6,167	6,467	6,205	6,199
Sodium compounds:					
Sodium carbonate (soda ash):					
Natural	179,700	192,000	200,185	e200,000	e180,000
Synthetic	217,900	231,008	257,223	e250,000	e250,000
Sulfate, natural (bloedite)[15]	395,287	413,238	r394,074	455,360	488,642
Stone, sand and gravel:					
Calcite, common[10]	344,793	480,986	400,516	437,118	486,740
Dolomite[10]	363,575	392,877	330,711	453,861	411,601
Limestone[10 16] thousand tons	35,276	29,055	30,840	28,919	23,735
Marble[10]	149,086	149,220	263,100	258,000	261,000
Quartz, quartzite, glass sand (silica)[10]	r1,188,330	r1,462,158	r1,479,100	886,411	965,921
Sand and gravel:					
Sand thousand cubic meters	50,564	52,031	r54,350	50,064	52,513
Gravel do	r132,744	33,694	r35,196	32,420	34,007
Strontium minerals (celestite)[10]	37,506	31,991	r32,320	24,042	47,739
Sulfur, elemental:					
Frasch process thousand tons	1,225	1,364	1,551	1,588	1,806
Byproduct:					
Of metallurgy[e] do	100	160	160	170	180
Of petroleum and natural gas do	377	462	469	462	498
Total do	1,702	1,986	2,180	2,220	e2,484

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987[p]
INDUSTRIAL MINERALS —Continued					
Talc[10]	11,032	8,900	29,900	24,301	17,469
Vermiculite[10]	399	505	[r]350	220	161
Wollastonite[10]	10,784	9,251	13,512	9,356	10,993
MINERAL FUELS AND RELATED MATERIALS					
Carbon black (negro de humo)	381,425	277,197	264,317	208,971	[e]285,000
Coal, run-of-mine:					
Metallurgical thousand tons	7,181	7,173	7,611	6,985	7,014
Steam do	1,818	2,215	2,160	3,173	4,122
Total do	8,999	9,388	9,771	10,158	11,136
Metallurgical coal, washed do	3,578	3,455	3,442	3,101	3,026
Coke:[17]					
Metallurgical thousand tons	2,960	2,885	2,890	2,594	2,330
Imperial do	9	35	6	6	6
Breeze do	27	8	5	4	4
Total do	2,996	2,928	2,901	2,604	2,340
Gas, natural:[18]					
Gross million cubic feet	1,479,560	1,373,457	1,315,337	1,252,352	1,276,926
Marketable do	[r]1,319,069	[r]1,242,905	[r]1,197,127	1,175,191	1,194,217
Natural gas liquids:[18] Field condensate thousand 42-gallon barrels	8,300	41,824	26,583	26,547	27,657
Petroleum:[18]					
Crude do	972,922	982,517	960,114	886,092	927,333
Refinery products:					
Gasoline:					
Aviation do	420	436	406	419	418
Motor, leaded and unleaded do	[r]128,499	[r]131,516	[r]130,084	129,296	134,291
Liquefied petroleum gas do	56,539	56,781	60,981	66,912	70,306
Jet fuel do	9,998	12,370	12,379	12,625	15,141
Kerosene do	14,258	11,654	11,286	9,798	11,009
Distillate fuel oil (diesel) do	81,745	85,358	89,726	88,521	84,817
Lubricants do	[r]2,453	[r]2,573	[r]2,504	2,386	2,602
Residual fuel oil do	127,819	137,210	145,253	147,974	154,939
Asphalt do	6,185	8,292	8,360	6,054	6,655
Unfinished crude oil[19] do	(20)	14,577	16,954	950	452
Unspecified do	[r]27,767	[r]24,414	[r]26,208	28,736	30,827
Refinery fuel and losses do	[r]11,294	[r]16,591	[r]14,763	10,903	8,289
Total do	466,977	501,772	518,904	504,574	519,746

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

[1]Table includes data available through Mar. 31, 1989.

[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 and impure bars plus refined metals.

[4]Asenic data as reported by the Consejo de Recursos Minerales. White Arsenic is As_2O_3. Impure arsenic is construed to be impure arsenic metal.

[5]Refined metal plus Bi content of impure smelter products.

[6]Estimated recoverable copper contained in products from primary production units. Primary refined copper includes cathode copper from the Cia. Minera de Cananea S.A. electrowinning plant: 1983—7,536 tons; 1984—9,289 tons; 1985—8,034 tons; 1986—8,033 tons; and 1987—9,662 tons. Camara Minera de México, 1988.

[7]Calculated from reported Fe content on the basis of concentrate and pellets containing 66% iron. Total run-of-mine output in 1986 was just under 15 million tons.

[8]Reported production of calcined Manganese ore.

[9]Based on exports, comprised mostly of pumice stone and emery—a granular impure variety of corundum.

[10]Fideicomiso de Minerales No-Metallicos Mexicanos.

[11]Instituto Mexicana de la Fluorita.

[12]Reported by Industrias Peñoles S.A. de C.V. (Peñoles) as the only major producer.

[13]Nitrogen content of ammonia produced by PEMEX plus liquid nitrogen.

[14]Includes only output used to manufacture fertilizers.

[15]Series reflects output reported by Peñoles, Mexico's principal producer, plus an additional estimated 30,000 tons by a smaller operator.

[16]Excluding that for cement production.

[17]Includes coke made from imported metallurgical coal.

[18]Memoria de Labores 1987, Petróleos Mexicanos.

[19]Specified by PEMEX as "virgin stock-28" and was processed at its refineries primarily for export. Exports of virgin stock-28 were suspended during 1986 and replaced by refinery products with greater value added.

[20]Revised to zero.

TRADE

Exports of petroleum and petroleum products were by far the most significant factor in Mexico's foreign trade, totaling $8.5 billion or 41% of total exports in 1987. When exports of nonfuel minerals of $1.2 billion were included, total mineral-based exports were $9.7 billion or 47% of total exports. Crude oil was the largest single contributor to the increased value of exports, due both to increased volume and higher prices. Increased prices for several metals and increased volume of exports of silver and sulfur, more than offset decreases in exports of lead, fluorspar, and other commodities.

Significant trade agreements reached in 1987 related primarily to trade in steel products. A bilateral trade and investment agreement between Mexico and the United States, which supplements the General Agreement on Tariffs and Trade (GATT), was signed in November 1987. A further agreement was signed in December under which Mexico agreed to reduce tariffs and eliminate reference prices for steel imports while the United States agreed to an upward adjustment in the Mexican steel quota.

Mexico continued to be self-sufficient with respect to many mineral products, although virtually all of its potash and much of its aluminum, iron and steel scrap, finished steel products, and phosphates were imported.

Mexico was one of the United States principal trading partners, particularly with respect to minerals and crude petroleum. In addition to crude oil, Mexico is a major supplier to the United States of celestite, cement, fluorspar, ferroalloys, natural graphite, silver, sodium sulfate, steel, sulfur, and zinc. The United States is a major supplier to Mexico of alumina and aluminum products, fertilizer materials including phosphate rock and potash, scrap iron, specialty clays, sodium carbonate, steel, sulfur, and talc. Mexico's secondary lead smelters also process significant quantities of scrap material that for enviromental reasons can no longer be processed in the United States.

Table 2.—Mexico: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	17	203	(2)	Belgium-Luxembourg 193; Guatemala 7; Peru 2.
Metal including alloys:				
Scrap	4,898	5,291	5,272	Belgium-Luxembourg 19.
Unwrought	225	2,672	2,672	
Semimanufactures	2,301	1,125	806	NA.
Antimony:				
Ore and concentrate	3,291	3,510	3,510	
Metal including alloys, all forms	185	140	71	Brazil 69.
Arsenic: Oxides and acids	3,399	4,330	4,270	Brazil 60.
Bismuth:				
Ore and concentrate	15	--	--	
Metal including alloys, all forms	496	673	463	Belgium-Luxembourg 96; Brazil 52.
Cadmium: Metal including alloys, all forms	[3]528	549	447	United Kingdom 45; Brazil 27.
Chromium: Oxides and hydroxides	NA	13	(2)	Peru 8; Chile 3; Guatemala 1.
Copper:				
Ore and concentrate	582,343	298,709	10,029	West Germany 106,500; Spain 70,900; China 51,880.
Oxides and hydroxides	20	261	256	China 3; Japan 2.
Sulfate	190	851	836	Guatemala 13; Panama 2.
Metal including alloys:				
Scrap	2,770	4,814	3,835	Republic of Korea 956; France 23.
Unwrought	11,205	19,117	19,117	
Semimanufactures	8,209	13,338	11,169	NA.
Iron and steel:				
Iron ore and concentrate	505	1,281	37	Belgium-Luxembourg 1,003; Costa Rica 90.
Metal:				

See footnotes at end of table.

Table 2.—Mexico: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Scrap	21,238	21,747	21,681	France 65; Canada 1.
Pig iron, cast iron, related materials	87	67	49	France 12; West Germany 6.
Ferroalloys:				
Ferromanganese	49,943	7,300	6,263	Canada 417; Colombia 403.
Ferrosilicomanganese	332	19	19	
Ferrosilicon	638	32	21	Colombia 11.
Unspecified	136	235	1	Venezuela 175; Brazil 31; Japan 19.
Steel, primary forms	12,778	153,274	72,106	NA.
Semimanufactures:				
Bars, rods, angles, shapes, sections	207,858	405,017	81,564	NA.
Universals, plates, sheets	120,422	363,798	146,428	NA.
Hoop and strip	4,090	2,939	2,885	France 46; Guatemala 6.
Rails and accessories	2	70	22	Guatemala 48.
Wire	2,191	8,266	5,056	Canada 1,306; Belize 959.
Tubes, pipes, fittings	204,075	154,078	114,892	NA.
Castings and forgings, rough	23,935	23,223	22,745	Belgium-Luxembourg 186; West Germany 95.
Unspecified	(4)	--		
Lead:				
Ore and concentrate	9,874	5,618	626	Belgium-Luxembourg 3,912; Spain 1,080.
Oxides	23,549	25,130	11,328	Japan 8,003; Colombia 1,032.
Metal including alloys:				
Scrap	2,122	1,852	1,792	Guatemala 40.
Unwrought	107,003	104,003	26,636	Belgium-Luxembourg 36,256; Italy 15,842.
Semimanufactures	962	421	270	Belize 41; El Salvador 40.
Magnesium: Metal including alloys, all forms	80	289	289	
Manganese:				
Ore and concentrate:				
Battery-grade	19,679	31,023	16,786	Colombia 3,806; Japan 3,000.
Metallugical-grade	110,206	83,877	16,717	Norway 28,910; Venezuela 23,520.
Oxides	--	6	5	Costa Rica 1.
Mercury 76-pound flasks	2,677	4,505	908	Brazil 2,117; Argentina 986.
Molybdenum:				
Ore and concentrate	14,533	2,875	--	United Kingdom 1,280; West Germany 1,022; Netherlands 499.
Metal including alloys, all forms	--	229	228	West Germany 1.
Nickel:				
Ore and concentrate kilograms	--	15	--	All to Guatemala.
Matte and speiss	23	3	2	West Germany 1.
Ash and residue containing nickel	20	--		
Metal including alloys, semimanufactures	18	15	10	Guatemala 2; Denmark 1.
Platinum-group metals: Metals including alloys, unwrought and partly wrought troy ounces	41,378	1,447	1,447	
Silver: Metal including alloys, unwrought and partly wrought thousand troy ounces	59,637	55,596	46,335	Japan 6,349; West Germany 1,200.
Tin:				
Ore and concentrate	9	908	--	All to Belgium-Luxembourg.
Oxides	7	--		
Metal including alloys:				
Scrap	--	2	2	
Unwrought	--	171	170	Guatemala 1.
Semimanufactures	97	191	190	Do.
Titanium:				
Ore and concentrate kilograms	--	110	110	
Oxides	1,060	818	33	El Salvador 402; Guatemala 304; Honduras 69.
Tungsten:				
Ore and concentrate	1,093	772	772	
Metal including alloys, all forms	3	57	7	Sweden 30; West Germany 13.

See footnotes at end of table.

Table 2.—Mexico: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Vanadium: Ash and residue containing vanadium	251	1,360	1,360	
Zinc:				
Ore and concentrate	214,657	197,774	18,130	Belgium-Luxembourg 69,129; U.S.S.R. 33,220; Italy 26,110.
Oxides	17,982	20,563	18,984	United Kingdom 1,186; Uruguay 109.
Blue powder	3,051	2,650	2,318	Australia 108; Argentina 104.
Ash and residue containing zinc	443	1,446	1,230	Uruguay 216.
Metal including alloys:				
Scrap	(4)	--		
Unwrought	78,292	73,929	47,670	Japan 9,492; Costa Rica 4,065.
Semimanufactures	7,752	12,294	169	Costa Rica 5,901; Argentina 1,699; Dominican Republic 1,597.
Other:				
Ores and concentrates	--	14	14	
Ashes and residues	1,532	172	42	China 100; Japan 16.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	246	1,457	1,455	Brazil 1; Dominican Republic 1.
Artificial: Silicon Carbide	313	1,791	667	Japan 1,050; Republic of Korea 74.
Dust and powder of precious and semiprecious stones kilograms	9	12	10	Ireland 2.
Grinding and polishing wheels and stones	288	165	158	Honduras 2; United Kingdom 2.
Asbestos, crude	49	(3)	--	All to West Germany.
Barite and witherite	34,675	29,792	29,792	
Boron materials:				
Crude natural borates	13	63	13	Colombia 50.
Oxides and acids	20	1	--	Mainly to Dominican Republic.
Cement thousand tons	4,620	3,717	3,615	Belize 42; Venezuela 14.
Chalk	--	475	475	
Clays, crude:				
Bentonite	7,170	11,488	6,212	Netherlands 5,258; United Kingdom 18.
Fuller's earth	--	22	22	
Kaolin	2,527	2,012	1	Cuba 2,011.
Unspecified	129	56	(3)	Colombia 20; Peru 13; El Salvador 8.
Cryolite and chiolite kilograms	6	263	--	All to West Germany.
Diatomite and other infusorial earth	4,469	5,461	122	West Germany 1,350; Argentina 1,119; Colombia 1,113.
Feldspar	6	688	688	
Fertilizer materials: Manufactured:				
Ammonia	390,039	96,592	43,848	Spain 28,083; Belgium-Luxembourg 13,841.
Nitrogenous	38,922	81,933	24,325	Netherlands 17,260; Colombia 15,279.
Phosphatic	280	25,244	95	U.S.S.R. 15,056; Peru 6,732; Guyana 3,011.
Potassic	7,307	120	120	
Unspecified and mixed	821	528	526	Netherlands 2.
Fluorspar (total)	564,622	437,526	246,108	Netherlands 73,531; Canada 72,352.
Of which:				
Acid-grade	271,557	NA		
Other grades including ceramic	293,065	NA		
Graphite, natural	19,298	18,919	17,633	Spain 1,283; Panama 2.
Gypsum and plaster thousand tons	3,899	2,269	2,040	India 86; Canada 56.
Iodine	1	16	--	All to West Germany.
Lime	46,868	18,578	17,998	Belize 580.
Magnesium compounds:				
Magnesite, crude	--	4	--	All to Nicaragua.
Oxides and hydroxides	28,995	44,342	13,456	West Germany 14,380; Argentina 6,543.
Meerschaum, amber, jet	51	(3)	(3)	
Mica: Crude including splittings and waste	6	29	27	Panama 2.
Phosphates, crude	353	55	--	Mainly to Japan.
Pigments, mineral: Iron oxides and hydroxides, processed	2,640	2,741	2,395	Canada 139; Japan 108.
Precious and semiprecious stones other than diamond:				
Natural kilograms	5,441	834	699	Japan 129; Spain 2.
Synthetic do	550	46	46	

See footnotes at end of table.

Table 2.—Mexico: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Salt and brine thousand tons	8,993	4,435	1,611	Japan 2,462; Canada 285.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	1,044	1,857	--	Mainly to Cuba.
Sulfate, manufactured	143,808	157,283	91,303	Brazil 43,255; Colombia 3,964.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	2,427	2,164	1,566	China 341; Italy 50.
Worked	12,655	14,602	13,827	Canada 598; Panama 77.
Dolomite, chiefly refractory-grade	1,121	1,461	1,065	El Salvador 200; Panama 100.
Gravel and crushed rock	44,055	6,706	6,706	
Limestone other than dimension	117,760	104,636	104,636	
Quartz and quartzite	20	76	76	
Sand other than metal-bearing	83,364	28,986	28,878	Guatemala 48; El Salvador 43.
Sand and gravel	18,223	11,347	11,315	Honduras 15; Nicaragua 13.
Strontium minerals: Celestite	40,207	30,698	28,121	Japan 2,577.
Sulfur:				
Elemental:				
Crude including native and by-product thousand tons	1,644	1,031	715	Romania 112; United Kingdom 81.
Colloidal, precipitated, sublimed	20	--		
Unspecified	33	(2)	--	All to Guatemala.
Dioxide	120	110	90	Costa Rica 20.
Sulfuric acid	456	321	23	Guatemala 213; Panama 84.
Talc, steatite, soapstone, pyrophyllite	18	20	--	El Salvador 15; Panama 5.
Vermiculite	149	66	66	
Other:				
Crude	183	333	227	Venezuela 80; Colombia 20.
Slag and dross, not metal-bearing	55	410	256	Venezuela 154.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	193,983	77,436	74,402	Costa Rica 2,717; Guatemala 120.
Carbon black	41,214	36,433	14,504	Switzerland 7,586; Cuba 3,300.
Coal: All grades including briquets	168	831	582	Belize 232; Guatemala 17.
Coke and semicoke	163,535	24,358	7	Philippines 24,351.
Peat including briquets and litter	212	25	25	
Petroleum:				
Crude thousand 42-gallon barrels	524,943	470,450	226,533	Spain 71,700; Japan 66,200.
Refinery products:				
Liquefied petroleum gas do	6,635	11,121	5,148	NA.
Gasoline, motor do	7,148	3,766	--	NA.
Kerosene and jet fuel do	1,947	2,550	501	NA.
Distillate fuel oil do	5,492	9,259	6,487	NA.
Residual fuel oil do	8,983	14,553	9,741	NA.
Asphalt do	--	16	NA	NA.
Unfinished crude oil do	16,954	950	NA	NA.

[r]Revised. NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Boletin Informativo. Instituto Mexicano del Zinc, Plomo y Coproductos A.C.
[4]Revised to zero.

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

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	46,659	35,086	28,108	Guyana 6,024; unspecified 954.
Oxides and hydroxides	197,657	88,121	83,476	Japan 2,836; Brazil 633.
Metal including alloys:				
Scrap	54,050	18,218	18,043	France 70; Canada 57.
Unwrought	45,236	16,085	11,271	Canada 4,315; Venezuela 500.
Semimanufactures	28,639	18,796	15,891	NA.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Antimony: Oxides	34	29	17	West Germany 11; Netherlands 1.
Arsenic: Metal including alloys, all forms	5	43	43	
Beryllium: Metal including alloys, all forms kilograms	55	36	36	
Bismuth: Metal including alloys, all forms	134	(2)	(2)	
Cadmium: Metal including alloys, all forms	2	42	42	
Chromium:				
Ore and concentrate	63,761	27,781	8,601	Cuba 7,895; Turkey 6,500.
Oxides and hydroxides	70	63	63	
Cobalt:				
Oxides and hydroxides	100	151	67	Belgium-Luxembourg 58; Netherlands 24.
Metal including alloys, all forms	124	71	26	Belgium-Luxembourg 35; Canada 7.
Columbium and tantalum: Metal including alloys, all forms, tantalum kilograms	273	184	179	West Germany 3; United Kingdom 2.
Copper:				
Oxides and hydroxides	20	11	7	United Kingdom 3; Panama 1.
Metal including alloys:				
Scrap	24,655	7,451	7,449	Ethiopia 2.
Unwrought	11,843	437	437	
Semimanufactures	10,926	2,963	1,878	NA.
Unspecified	62,745	8,121	3,422	Chile 4,699.
Iron and steel:				
Iron ore and concentrate	2,137	208,617	101,121	Belgium-Luxembourg 54,918; Chile 51,574.
Metal:				
Scrap	839,890	430,502	365,979	West Germany 29,651; Japan 3,922.
Pig iron, cast iron, related materials	20,879	10,482	8,014	Canada 1,125; Panama 800.
Ferroalloys:				
Ferrochromium	327	25	25	
Ferromanganese	389	108	107	Switzerland 1.
Ferromolybdenum	52	43	43	
Ferronickel	339	49	49	
Ferrosilicomanganese	20	31	31	
Ferrosilicon	1,412	579	393	Brazil 156; West Germany 21.
Unspecified	4,354	2,335	1,527	NA.
Steel, primary forms	411,661	NA		
Semimanufactures:				
Bars, rods, angles, shapes, sections	74,870	NA		
Universals, plates, sheets	290,664	NA		
Hoop and strip	78,448	NA		
Rails and accessories	244,617	NA		
Wire	12,433	NA		
Tubes, pipes, fittings	51,586	NA		
Unspecified	(3)	--		
Lead:				
Oxides	179	27	27	
Metal including alloys:				
Scrap	503	1,056	1,056	
Unwrought	336	28	28	
Semimanufactures	116	13	13	

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Lithium: Oxides and hydroxides	361	156	57	Hong Kong 99.
Magnesium: Metal including alloys:				
Scrap	75	17	3	Unspecified 14.
Unwrought	1,121	965	812	Sweden 69; Norway 43.
Semimanufactures	139	101	101	
Manganese:				
Ore and concentrate	146,454	112,353	23,913	Panama 87,443; Congo 993.
Oxides	1,452	1,826	308	Belgium-Luxembourg 719; Brazil 382.
Mercury 76-pound flasks	199	7	7	
Molybdenum:				
Ore and concentrate	52	--		
Metal including alloys:				
Unwrought	15	19	(2)	Mainly from Austria.
Unspecified	11	8	3	Netherlands 4; Japan 1.
Nickel:				
Matte and speiss	3,539	1,896	1,217	Canada 591; Cuba 24.
Oxides	125	64	5	Cuba 33; Canada 26.
Metal including alloys, semimanufactures	1,505	2,662	537	NA.
Platinum-group metals: Metals including alloys, unwrought and partly wrought:				
Palladium troy ounces	1,254	NA		
Platinum do	4,343	NA		
Rhodium do	64	NA		
Unspecified do	1,010	NA		
Selenium, elemental	25	25	21	United Kingdom 4.
Silver: Metal including alloys, unwrought and partly wrought troy ounces	3,504	5,530	4,951	Italy 386; West Germany 193.
Tin:				
Ore and concentrate	5,503	6,311	6,229	Singapore 62; Bolivia 20.
Oxides	--	39	39	
Metal including alloys:				
Scrap	156	135	135	
Unwrought	72	67	67	
Semimanufactures	70	12	6	West Germany 4; United Kingdom 1.
Titanium:				
Ore and concentrate	52,918	47,129	5	Australia 47,124.
Oxides	1,443	1,405	437	West Germany 495; Belgium-Luxembourg 245.
Metal including alloys, all forms	144	42	38	West Germany 4.
Tungsten:				
Ore and concentrate	72	(2)	(2)	
Metal including alloys, all forms	125	43	18	Austria 19; Netherlands 2.
Zinc:				
Oxides	159	96	96	
Blue powder	699	239	126	Belgium-Luxembourg 112.
Metal including alloys:				
Scrap	1,193	1,376	1,372	Ethiopia 4.
Unwrought	2	2	2	
Semimanufactures	434	184	176	West Germany 6; Netherlands 2.
Zirconium: Ore and concentrate	4,678	1,177	821	Australia 237; Austria 43.
Other:				
Ores and concentrates	7,753	426	374	United Kingdom 19; Netherlands 18.
Base metals including alloys, all forms	667	308	238	West Germany 21; Belgium-Luxembourg 12.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	763	1,061	1,002	West Germany 58; Switzerland 1.
Artificial:				
Corundum	4,350	1,446	133	Brazil 582; West Germany 461; Austria 266.
Silicon carbide	521	135	59	Brazil 76.
Grinding and polishing wheels and stones	458	345	230	West Germany 84; Italy 11.
Asbestos, Crude	54,871	28,209	7,461	Canada 14,089; Republic of South Africa 3,009.
Barite and witherite	16	99	98	Switzerland 1.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Boron materials: Crude natural borates	1,913	976	976	
Bromine	156	99	99	
Cement	9,592	8,438	5,303	France 2,277; Brazil 296.
Chalk	5,322	1	(2)	Mainly from Switzerland.
Clays, crude:				
Bentonite	685	509	507	United Kingdom 2.
Kaolin	91,219	85,424	85,229	Spain 79; United Kingdom 59.
Unspecified	131,784	109,818	109,285	West Germany 210; France 199.
Cryolite and chiolite	86	832	(2)	Denmark 817; Belgium-Luxembourg 14.
Diamond:				
Industrial stones kilograms	816	139	71	Italy 60; United Kingdom 4.
Dust and powder do	1,348	548	509	Belgium-Luxembourg 18; West Germany 12.
Diatomite and other infusorial earth	142	513	502	United Kingdom 10.
Feldspar, fluorspar, related materials	1,043	4,448	4,328	Canada 112; West Germany 8.
Fertilizer materials:				
Crude, n.e.s	1,016	791	790	Australia 1.
Manufactured:				
Ammonia	76,950	27,070	12,931	Venezuela 14,138.
Nitrogenous	117,610	184,321	3,598	Romania 148,177; U.S.S.R. 32,195.
Phosphatic	403,453	249,732	183,896	Tunisia 33,000; Israel 32,836.
Potassic	37,173	29,181	29,181	
Unspecified and mixed	116,467	1,953	1,364	Spain 316; Belgium-Luxembourg 233.
Graphite, natural	46	48	20	Brazil 16; West Germany 7.
Gypsum and plaster	11,400	8,546	8,527	West Germany 15; Spain 4.
Iodine	322	141	131	Japan 7; West Germany 2.
Lime	896	729	729	
Magnesium compounds:				
Magnesite, crude	9	1,573	1,562	France 7; Belgium-Luxembourg 4.
Oxides and hydroxides	920	1,701	1,661	Italy 20; West Germany 8.
Mica:				
Crude including splittings and waste	132	153	126	West Germany 18; United Kingdom 5.
Worked including agglomerated splittings	92	94	89	Belgium-Luxembourg 3; Sweden 1.
Phosphates, crude thousand tons	1,038	1,097	295	Morocco 772; Jordan 30.
Pigments, mineral: Iron oxides and hydroxides, processed	448	588	568	West Germany 16; United Kingdom 3.
Potassium salts, crude	239,840	144,588	31,748	Canada 49,209; U.S.S.R. 42,626.
Precious and semiprecious stones other than diamond:				
Natural kilograms	805	40,215	NA	NA.
Synthetic do	1,803	41,874	710	France 31,986; Switzerland 5,600; Thailand 3,510.
Pyrite, unroasted	151	124	20	West Germany 104.
Quartz crystal, piezoelectric kilograms	23,583	36	36	
Salt and brine	584	660	595	West Germany 65.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	94,632	78,191	78,191	
Sulfate, manufactured	40	50	15	Netherlands 35.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	3,582	1,667	546	Italy 489; Cuba 364.
Worked	11,973	9,781	9,528	Guatemala 96; Dominica 88.
Calcite, common	1,666	1,506	1,449	Italy 36; United Kingdom 19.
Dolomite, chiefly refractory-grade	38	1,497	1,497	
Gravel and crushed rock	7,101	2,799	2,770	Italy 20; United Kingdom 9.
Quartz and quartzite	773	405	285	Sweden 83; West Germany 20.
Sand other than metal-bearing	112,319	68,305	68,156	United Arab Emirates 88; Sweden 30.
Sulfur:				
Elemental:				
Crude including native and byproduct	56,883	239,342	115,786	Canada 123,421; Belgium-Luxembourg 135.
Colloidal, precipitated, sublimed	149	35	30	West Germany 5.
Sulfuric acid	38,775	22,383	22,383	
Talc, steatite, soapstone, pyrophyllite	149,220	79,279	77,749	Italy 840; France 240.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985[r]	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Vermiculite	658	462	457	China 5.
Other: Crude	12,076	9,051	8,623	Australia 237; Spain 68.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,908	1,048	1,047	West Germany 1.
Carbon black	209	NA		
Coal:				
Briquets of anthracite and bituminous coal thousand tons	1,064	240	129	Colombia 55; Canada 53.
Lignite including briquets	6,743	3,592	3,592	
All grades including briquets	(3)	--		
Coke and semicoke	151,342	61,396	25,221	Panama 39,076; Canada 99.
Gas, natural million cubic feet	2,081	1,789	1,789	
Peat including briquets and litter	256	268	268	
Petroleum refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	13,524	8,987	7,895	NA.
Gasoline, motor do	23	14	5	NA.
Mineral jelly and wax do	277	236	134	Brazil 79; Spain 12.
Kerosene and jet fuel do	439	504	290	NA.
Lubricants do	1,099	1,274	1,053	NA.
Residual fuel oil do	4,254	11,096	7,148	NA.
Petroleum coke do	883	880	826	Australia 54.

[r]Revised. NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Revised to zero.

COMMODITY REVIEW

METALS

Bismuth.—Production of refined bismuth increased for the fourth year and reached a total of 561 tons, which was the highest production since 1980. Exports were 489 tons, domestic consumption was 39 tons, and the balance of 33 tons apparently went into inventory, continuing a trend that has persisted since 1983. Most of the exports went to the North American market, for which Mexico is the largest supplier.

Cadmium.—Mine production of cadmium increased for the fourth year, and production of refined cadmium reached a new record high. Domestic cadmium consumption declined for the fifth year in a row to 174 tons but exports increased to 940 tons, and the total of domestic and foreign sales reached a new record high of 1,114 tons.

Copper.—There was notable change in 1987 for the Mexican copper industry. The two major producers, Cía. Minera de Cananea with its mine and smelter at Cananea and Mexicana de Cobre with its La Caridad mine and smelter near Nacozari, both in the State of Sonora, completed major expansion programs during the year. The Government, through Nacional Financiera S.A. (NAFINSA), assumed control of Mexicana de Cobre in order to avert a declaration of bankruptcy. Cananea was owned almost entirely by Government agencies. At year-end, the Government announced a plan to fully privatize Mexicana de Cobre. Also during the year, an agreement between Mexico and the United States limiting sulfur dioxide emissions from copper smelters on each side of the border was signed under the basic 1983 Border Environment Agreement.

The principal developments at La Caridad were the completion of the 230,000-ton-per-year smelter and the start of construction of a 500,000-ton-per-year sulfuric acid plant. Upon completion the plant should recover about 98% of the sulfur dioxide created in the copper smelting process. Worldwide marketing of the acid will be handled by a subsidiary of the Boliden Co. Reported copper production at La Caridad in 1987 was 131,208 tons, which included 80,811 tons of copper in concentrates and 52,418 tons in anodes.

At Cananea expansion of concentrator capacity to 95,000 tons per day was completed, and construction of a second solvent extraction-electrowinning (SXEW) plant to produce an additional 60 tons per day of cathodes was started. Completion of the concentrator expansion will enable the Cananea smelter to operate at its full capacity of 45,000 tons per year of blister copper. Retrofitting of emission controls at the Cananea smelter would be required only if the capacity of the smelter were to be increased. Concentrates that cannot be smelted at Cananea will either be smelted at La Caridad or exported. Cananea was reported to have acquired the copper smelter of Cía. Minera de Santa Rosalía S.A. at Santa Rosalía, Baja California, which would add 15,000 tons per year of smelting capacity when the smelter is refurbished. Reported production at Cananea included 37,068 tons of copper in concentrates, 43,922 tons of copper in blister copper, and 9,662 tons of copper in copper cathodes. Production included 1,570 tons of copper contained in purchased concentrates, resulting in net production from Cananea of 89,121 tons after consideration of the metallurgical loss in smelting of purchased concentrates.

Mexicana de Cobre operated Mexico's only copper refinery and produced 120,377 tons of refined copper in 1987. Proposals to expand the capacity of the existing plant and/or to build a new refinery in the northwestern region of Mexico, close to Cananea and La Caridad, were under study but no action was taken.

Domestic sales of refined copper were reported by different sources to be from 124,000 tons to 129,000 tons. Imports of refined copper were estimated to be approximately 30,000 tons for a total consumption of approximately 155,000 tons. Most of the concentrate production that was not smelted locally was exported.

Gold.—The Guanajuato district in the State of Guanajuato is the most important gold-producing area in Mexico, accounting for about one-fourth of reported Mexican gold production. The Torres Mining Complex—Industries Peñoles S.A. de C.V. (Peñoles), Cía. Minera Fresnillo S.A. de C.V., Lacana Mining Corp. of Toronto, Canada, and an agency of the Mexican Government have ownership interests—was the largest producer in the Guanajuato district with reported production of 42,959 troy ounces from six mines during the first 9 months of 1987. Other important gold producers in Mexico were Corporación Industrial Sanluis S.A. de C.V. from mines in the San Dimas district in the States of Durango and Sinaloa; Cía. Real del Monte y Pachuca S.A. from mines in the Pachuca area in the State of Hidalgo; and Cia. Minera de Cananea S.A. and Mexicana de Cobre as a byproduct from their porphyry-type copper mines in the State of Sonora.

Minera Zapata S. de R.L. de C.V., an affiliate of Phelps Dodge Corp. of Phoenix, Arizona, announced the discovery of significant gold mineralization in the northern portion of the State of Sonora and reported that studies to determine the economic viability of developing a gold mining operation had begun.

Iron Ore.—Mexican iron ore production increased slightly in 1987 to 7.5 million tons of pellets. Principal sources of crude ore were the Ferrotepec Mine in the Las Truchas district of Michoacán, the Peña Colorada Mine in Colima, the La Perla Mine in Chihuahua, and the Hércules Mine in Coahuila. Concentrators are operated at the mine sites. Pellet plants are operated in Colima by the Peña Colorada consortium and at steel plants at Lázaro Cárdenas, Michoacán (SICARTSA), and Monclova, Coahuila (AHMSA). In addition, 45,000 tons of iron ore pellets, 101,000 tons of lump ore, and 344,000 tons of sinter fines were imported.

Iron and Steel.—Production of crude steel in Mexico increased by 5% more than that of 1986 to 7.6 million tons, second only to the record high 7.7 million tons produced in 1981. Finished steel products (rolled products plus castings and forgings) produced totaled 5.8 million tons for a productivity (ratio of finished products to crude steel) of 77%, compared with the 5.6 million tons of finished products and productivity of 79% achieved in 1986.

Distribution of production by company and by product lines is shown in tables 4 and 5.

Table 4.—Mexico: Production of crude steel, by group and company

(Thousand metric tons)

Group and company	1985	1986	1987
Siderúrgica Mexicana (SIDERMEX) Group:			
Altos Hornos de México S.A. (AHMSA)	2,603	2,868	3,085
Fundidora de Monterrey S.A. (FMSA)[1]	943	255	--
Siderúrgica Lázaro Cárdenas-Las Truchas S.A. (SICARTSA)	613	1,192	1,190
Total	4,159	4,315	4,275
Private companies:			
Tubos de Acero de México S.A. (TAMSA)	279	233	466
Hylsa de México S.A. (HYLSA)	1,671	1,582	1,662
Others	1,258	1,045	1,168
Total	3,208	2,860	3,296
Grand total	7,367	7,175	7,571

[1]Permanently closed in 1986 after incomplete operating year.

Table 5.—Mexico: Production of finished steel, by type

(Thousand metric tons)

Type	1985	1986	1987
Castings and forgings	56	26	40
Rolled products:			
Flat-rolled	2,797	2,229	2,355
Nonflat products	2,953	3,116	3,148
Seamless tubes	292	208	288
Total	6,042	5,623	5,791

During 1987, 1.2 million tons of finished steel was exported and 331,000 tons was imported, compared with exports of 1.1 million tons and imports of 451,000 tons in 1986. Apparent domestic consumption of finished steel products was 4.9 million tons in 1987 compared with 5.0 million tons in 1986. The increased production, exports, and decreased apparent consumption can be attributed to the progressive rationalization and improvements in efficiency of the Mexican steel industry and also to the increased participation by Mexico in the U.S. market for imported steel and the continued economic restrictions on the domestic Mexican economy.

Principal developments in the Mexican iron and steel industry during the year were the continuation of the phase-2 expansion of the SICARTSA works at Lázaro Cárdenas, Michoacán; the implementation of plans to improve production efficiency at the iron ore and coal mines of the Sidermex Group in Chihuahua and Coahuila; and the submission of requests to the World Bank for the financing of an integrated program of modernization and quality improvement.

Production and export of ferroalloys continued to increase. The production of ferromanganese, silicomanganese, and ferromolybdenum, as well as the production of ferroalloys as a group, reached record-high levels. The most significant production increases over 1986 were of silicomanganese and ferrochromium. Cia. Minera Autlán continued to be the principal producing company.

Lead.—Indicated mine production of lead did not change significantly from that of 1986, nor did the production of primary and secondary refined lead. Reported domestic consumption of primary refined lead increased over that of 1986 by about 5,400 tons or 6.4% while exports decreased below that of 1986 by about 16,300 tons to 88,352 tons. The difference in indicated domestic consumption was largely in inventory accumulation and in increased use of tetraethyl lead in gasoline. This latter usage suggests that production of leaded gasoline for export was also a major end user of Mexican lead.

Manganese.—Production of metallurgical manganese ore in Mexico declined sharply from levels achieved in 1986, reflecting the depressed state of the world steel industry and resultant inventory surplus of manganese ore and ferroalloys. Minera Autlán continued to be the major producer, producing 581,300 tons of crude manganese carbonate ore and 336,000 tons of calcined

product from its mine and plant at Molango, Hildago. Production of battery-grade ore rose by 7% from 38,700 tons to 41,300 tons, reflecting the increased usage of dry cells in radios and similar consumer products. At yearend, demand for both calcined manganese ore for metallurgical use and battery-grade ore was picking up. Prices for manganese ore declined by about 5% during the year, whereas prices for ferroalloys generally rose, although not at the same rate as the general inflation.

Domestic sales of calcined manganese ore (nodules) declined slightly in 1987, whereas export sales rose. For the first year some sales of crude (uncalcined) manganese carbonate were made, leading to an overall increase in ore sales in 1987. Exports of standard- and medium-carbon ferromanganese declined while exports of silicomanganese increased, leaving total exports of manganiferous alloys virtually unchanged.

Late in the year, Minera Autlán announced plans to begin production of electrolytic manganese dioxide at a new plant in Tamos, Veracruz. Capacity of the plant was to be about 12,000 tons per year. The plant would be operated in conjunction with Minera Autlán's manganese sulfate plant at the same location.

Molybdenum.—Reported molybdenum production increased by approximately 31% over that of 1986. Principal producers continued to be Mexicana de Cobre, which recovers molybdenite as a byproduct from the La Caridad copper mine in Sonora, and Minera Cumobabi S.A. de C.V., a subsidiary of Empresas Frisco S.A. de C.V., which produces molybdenite as a primary product from its mine in Sonora. Recovery of molybdenite at La Caridad increased as a result of increased ore production, while production at Cumobabi declined as mine operations were adjusted to improve operating results.

Silver.—Mexico was the leading producer of mined silver in the world, and silver was the most important mineral produced in Mexico, aside from petroleum. Silver was produced from many mines, both large and small, and was generally a coproduct or principal product of those mines. The largest single mine was Real de Ángeles at Noria de Ángeles, Zacatecas, which produced 11.2 million troy ounces in 1987. Major producing companies included Peñoles and affiliates; Grupo Industrial Minera México S.A. de C.V. (Grupo IMMSA); Minerales de Bolaños S.A.; Minera Real de Ángeles S.A. de C.V.; Empresas Frisco; Industrial Sanluis; and Real del Monte y Pachuca. Virtually all the silver produced in Mexico, with the exception of that contained in exported copper concentrates and blister copper, is refined by Met-Mex Peñoles de C.V., a subsidiary of Peñoles, at its Torreón, Coahuila, metallurgical complex or by Industria Minera México S.A. (IMMSA) at its Monterrey, Nuevo León, complex.

Mine production of silver was not significantly different from that of 1986, with production decreases being registered at Real de Ángeles and IMMSA and increases being recorded by Peñoles and affiliates and Empresas Frisco. Indicated production of refined silver increased by 8% over that of 1986, suggesting that significant quantities of silver in inventory were moved to market during the year. Sales data indicated that 75% of the refined silver sold in 1987 was destined for export markets.

The San Antonio Mine of Industrial Sanluis was the only significant new mine opening reported in 1987. The mine is in the State of Sinaloa and was reported to have the capacity to produce 90,500 tons of concentrate containing 22,000 ounces of gold and 850,000 ounces of silver per year.

Zinc.—Mine production of zinc was essentially unchanged from that of 1986 while production of refined zinc increased 6% to approximately 186,000 tons. Reported domestic sales increased from about 85,000 tons to nearly 102,000 tons, while exports increased marginally over 1986 to nearly 89,000 tons. Total reported sales were almost 191,000 tons, indicating a significant reduction in refined metal inventory.

INDUSTRIAL MINERALS

Barite.—Production of barite in 1987 rebounded to more than 401,000 tons, 25% more than in 1986 but still significantly lower than the almost 468,000 tons produced in 1985. The largest producer was Barita de Sonora S.A. de C.V., a state-owned company with a capacity of about 100,000 tons per year. Peñoles also produced barite as a coproduct from its La Minita Mine in Michoacán. During 1987, barite production from La Minita increased to 79,316 tons from 58,030 tons produced in 1986.

Cement.—Production of cement in Mexico continued the trend of the past several years and increased to a record 22.7 million tons, approximately 70% of installed capacity of 32.9 million tons. This compares with production of 19.8 million tons and an operating rate of about 60% in 1986. The acquisition of Grupo Cemento Anahuac by Cementos Mexicanos S.A. raised the latter company's annual capacity to 15.2 million tons; the combined companies produced 11.7

million tons in 1987. The next largest producer was Cementos Tolteca, with annual capacity of 7.1 million tons.

During 1987 Mexico exported 4.5 million tons of clinker and cement, of which Cementos Mexicanos S.A. contributed 2.8 million tons. Cement from Mexico is now distributed throughout the Southwest and Gulf States as well as the Atlantic seaboard.

Fluorspar.—Reported fluorspar production declined modestly in 1987, although Mexico continued to be among the world's leading producers. Sales, as reported by the Instituto Mexicano de la Fluorita A.C., increased from 724,000 to 756,000 tons and exceeded reported production by about 32,000 tons, suggesting that there were significant inventory adjustments during the year. Reported export sales declined modestly to 441,000 tons, of which 283,000 tons was exports to the United States. Reported domestic sales increased to 315,000 tons.

Magnesium Compounds.—Mexico's production of magnesia rose more than 18% from the low level of 1986. Magnesia and sodium sulfate are produced from brines by Quimica del Rey S.A. at Laguna del Rey, Coahuila, while magnesia is produced from seawater by Quimica del Mar S.A. at Ciudad Madero, Tamaulipas. Both companies are subsidiaries of Peñoles. Reported exports of magnesium oxide increased to about 16,000 tons.

Phosphate Rock.—Principal producers of phosphate rock continued to be Roca Fosfórica Mexicana S.A. de C.V. (ROFOMEX), with its mine and plant at San Juan de la Costa in Baja California Sur, and Minerales Industriales S.A. de C.V., with its mine in the Municipio de Pacula, Hidalgo. ROFOMEX produced 467,942 tons of phosphate concentrates with an average grade of 30.28% P_2O_5 and shipped 457,415 tons, equal to about 21% of apparent national consumption.

During 1987, ROFOMEX continued its modernization and development program. Emphasis was placed on development of an underground mine to replace production from the open-cut mine when depleted. The underground mine will use both continuous miners and conventional room and pillar mining. The company stopped work in the Santo Domingo deposit, also in Baja California Sur; took steps to improve mill recovery; built several new houses to reduce employee turnover; developed a new financing plan; and took other steps to reduce losses and improve its return on investment.

Apparent domestic consumption of phosphate rock was 2.2 million tons, of which about 29% was produced locally. Principal sources of imported phosphate rock were Morocco and the United States.

Salt.—Mexico was one of the major salt-producing nations in the world with reported production of 6.4 million tons. The principal producer was Exportadora de Sal S.A. de C.V. (ESSA), which has the capacity to produce 5 million tons per year by solar evaporation at Guerrero Negro, Baja California. Domestic consumption is about 1 million tons per year with the balance exported, mainly to Japan and the United States.

Strontium Minerals.—Mexico's production of celestite (strontium sulfate) continued to grow, reaching a record-high level of almost 48,000 tons. Major producers are Cía. Minera La Valenciana S.A. (CMV) from its mine near Torreón, Coahuila, and Sales y Oxidos S.A. from mines near Monterrey, Nuevo León. CMV and Sales y Oxidos each convert part of their production to strontium carbonate in plants at Torreón and Monterrey, respectively. During 1987, 27,500 tons of celestite was exported to the United States and 2,000 tons was exported to Japan. The balance of Mexican celestite was converted to strontium carbonate in Mexico. Most of the strontium carbonate product was also exported to the Far East and the United States.

Sulfur.—Mexico produced sulfur from Frasch mines at the Isthmus of Tehuantepec, as byproduct sulfur recovered from sour crude oil and natural gas, and as sulfuric acid produced as a byproduct from metallurgical operations. Frasch mines were operated by state-owned Azufrera Panamericana S.A. at Coachapa and Jáltipan and by Cía. Exploradora del Istmo S.A., owned 66% by the State and 34% by Texasgulf Inc., at Texistepec, all in the State of Veracruz. Principal sources of byproduct sulfuric acid include the smelting complex of Peñoles at Torreón, Coahuila, which produced 334,669 tons in 1987; the San Luis Potosí smelter of IMMSA and the Mexicana de Cobre smelter at La Caridad. When the La Caridad acid plant is operating at full capacity, the total byproduct sulfuric acid capacity in Mexico will be well over 1 million tons annually.

Apparent domestic consumption of sulfur was about 1 million tons, or about 50% of total production. Reported exports were 910,094 tons. Mexicana de Acido, a subsidiary of Mexicana de Cobre, was building

a maritime terminal in Guaymas, Sonora, to facilitate shipment of sulfuric acid from the La Caridad smelter.

MINERAL FUELS

Coal.—The only significant mining of coal in Mexico took place in the Fuentes—Río Escondido and Salinas Basins in the State of Coahuila. The Fuentes—Río Escondido Basin is close to the city of Piedras Negras on the Río Grande. Steam coal from this basin was mined by Minera Carbonífera Río Escondido S.A. (MICARE) from three underground and two open-cut mines, and was used exclusively for power generation at the nearby 1.2-megawatt Río Escondido thermal power station. Steam coal production in 1987 was 4.1 million tons.

The Salinas Basin is situated between Piedras Negras and the city of Monclova. The principal mines in this basin are operated by the mining units of the Government-owned steel companies grouped under Siderúrgica Mexicana (SIDERMEX), which produced 5.7 million tons of metallurgical coal; Groupo IMMSA, which produced 535,495 tons; and the Comisión de Fomento Minero, which produced 877,604 tons. Total run-of-mine production was 7.0 million tons. Virtually all of the coal produced from the Salinas Basin was shipped to washing plants, from which metallurgical coal was recovered. Raw coal washed was 6.9 million tons, from which 3.0 million tons of washed coal was recovered. Reported shipments of clean coal were 3.0 million tons, of which 2.2 million tons went to coke plants in the Coahuila area, 7,833 tons went to the Comisión Federal de Electricidad for power generation, and the balance of 742,803 tons presumably went to the SICARTSA steel plant in Lázaro Cárdenas, Michoacán. Reported coke production was 2.3 million tons, whereas total shipments were reported to be 2.4 million tons, indicating an inventory drawdown of about 100,000 tons. Shipments to steel plants were 2.1 million tons, or 85% of total shipments.

Coke production declined for the fifth year in a row, and was 25% below the record-high level of 3.1 million tons produced in 1981. During the same period, production of pig iron remained relatively constant, reaching a high of 3.9 million tons in 1984 versus a prior low of 3.5 million tons in 1983. The overall pattern of declining coke production versus stable pig iron production suggests that the Mexican steel industry has achieved a substantial reduction in the coke rate (coke consumed per unit of iron produced) in the past several years.

Petroleum and Natural Gas.—During 1987, Mexico produced 2.624 million barrels of crude oil, condensate, and natural gas liquids and 3,431.1 million cubic feet of natural gas per day, ranking 5th and 13th place, respectively, in the world, and representing increases over 1986 production of approximately 4.5% and 2.0%, respectively. Throughput at refineries and petrochemical plants was 1.334 million barrels per day and crude oil exports were 1.334 million barrels per day. All of Mexico's natural gas production was used within the country.

Exploration, production, refining, and sale of petroleum and natural gas in Mexico is a state monopoly and is carried out by the national petroleum company, Petróleos Mexicános (PEMEX). Export sales of crude oil and refined products were $8.48 billion as compared with imports of refined products of $446 million, leaving a net positive contribution to the national trade accounts of $8.03 billion. PEMEX was Mexico's largest industry, contributing about 10% of the gross domestic product and 40% of national revenue.

Mexico's hydrocarbon production was from fields bordering or in the Gulf of Mexico, which were grouped for reporting purposes into five zones. The most important of these was the Marine Zone, which encompasses a group of offshore fields in the Bay of Campeche and produced about 66% of Mexico's crude oil and 28% of Mexico's natural gas. The Southeastern Zone, comprised of several fields in the States of Chiapas, Tabasco, and the southeastern portion of the State of Veracruz was the next most important, producing about 26% and 55% of Mexico's crude oil and natural gas, respectively. The Southern Zone, lying to the west and southwest of the City of Veracruz, and the Central Zone, centered on Poza Rica in northern Veracruz and including the offshore wells of the famous "Golden Lane" were about equal in importance, with each producing about 3% and 3.5% of Mexico's crude oil and natural gas, respectively. The Northern Zone, encompassing the coastal regions north of Tampico and extending northwesterly from Matamoros along the Río Grande valley was more important for natural gas than for oil, producing about 10% of Mexico's natural gas but less than 2% of Mexico's crude oil.

Table 6.—Mexico: Petroleum and natural gas production

Zone and district	Natural gas (million cubic feet)			Crude oil[1] (thousand 42-gallon barrels)		
	1985	1986	1987	1985	1986	1987
Marine Zone: Bay of Campeche	348,387	316,711	353,880	621,646	567,305	615,475
Southeastern Zone:						
Villahermosa[2]	665,344	643,532	642,963	260,963	241,449	238,243
Comalcalco District	7,144	8,395	5,789	6,202	6,120	5,008
Ciudad Pemex	79,630	71,686	59,624	4	10	24
Total[3]	752,118	723,613	708,376	267,168	247,579	243,270
Southern Zone:						
Agua Dulce District	14,157	15,950	24,306	14,525	14,470	14,825
El Plan District	15,079	17,812	19,989	10,473	10,159	10,416
Nanchital District	1,162	1,022	868	1,433	1,351	1,300
Total[3]	30,398	34,784	45,163	26,430	25,980	26,542
Central Zone:						
Poza Rica	30,977	26,755	24,840	27,193	26,480	23,966
Papaloapan Basin	22,181	20,805	20,645	2,487	2,463	2,364
Nueve Faja de Oro	2,606	1,350	--	--	--	--
Total[3]	55,764	48,910	45,485	29,660	28,944	26,330
Northern Zone:						
Northern District	13,056	16,534	16,971	8,444	9,312	9,006
Southern District	7,162	6,862	8,037	6,667	6,880	6,635
Northern Frontier District	108,452	104,938	99,014	99	92	76
Total[3]	128,670	128,334	124,022	15,210	16,285	15,717
Grand total[3]	1,315,337	1,252,352	1,276,926	960,114	886,092	927,335

[1]Does not include condensate.
[2]Referred to as Mesozoic.
[3]Data may not add to totals shown because of independent rounding.

Source: Petróleos Mexicanos, Memoria de Labores, 1985, 1986, and 1987.

PEMEX operates 9 refineries, plus an additional 11 petrochemical and natural gas treatment plants, and the country was essentially self-sufficient with respect to petroleum-based products. Some specialty lubricants and petrochemical feedstocks are imported, along with very small quantities of natural gas, but these imports were more than offset by exports of other refinery and feedstock products.

Table 7.—Mexico: Salient crude oil statistics

	1983	1984	1985	1986	1987
Exports:					
Quantity, thousand 42-gallon barrels	561,005	556,479	524,943	470,704	490,962
Value, millions	$14,821	$14,968	$13,296	r$5,582	$7,885
Share of total Mexican exports, percent	69	62	61	35	41
To the United States:					
Total, thousand 42-gallon barrels	279,703	252,454	299,011	238,176	214,665
Share of total U.S. imports, percent	23	19	19	16	12

rRevised.

Exploration activity in 1987 was considerably reduced, with a total of 103 wells completed during the year, compared with 246 wells completed during 1986. Of the wells drilled in 1987, 27 were exploration or wildcat wells while the remaining 76 were development wells. Six of the exploration wells resulted in oil or oil and gas discoveries, with the most important being the Iride 140 and Gaucho 1 wells in the Villahermosa, Tabasco area, yielding 2,447 and 1,050 barrels of oil per day, respectively, and the Huatempo 1 well in the Northeastern Frontier area, which yielded 3.9 million cubic feet of gas per day. Of the 105 wells drilled, 66 were completed as producers, with 33 of these wells being in the Bay of Campeche. One offshore well, the Yun-2 in the Bay of Campeche blew-out and caught fire in October 1987, but the oil spill

was contained and the fire extinguished without notable environmental damage. A total of 121 wells were either completed or drilling at yearend for a total length of 466,814 meters or 3,858 meters per well. Although the average depth per well decreased slightly in 1987, the average depth of exploration wells increased dramatically from 4,464 to 5,362 meters.

Crude oil reserves at yearend were 47.176 billion barrels of oil and 6.934 billion barrels of condensate. Although condensate reserves rose slightly, total liquid hydrocarbon reserves declined for the fourth year in a row. During the 1983-87 period, PEMEX produced a total of 6.5 billion barrels of oil and oil equivalents and found a total of 3.5 billion, for a net decrease of 3.0 billion barrels. Total hydrocarbon reserves at yearend were 69 billion barrels of oil equivalent.

[1]Economic geologist, Division of International Minerals.

Table 8.—Mexico: Proven hydrocarbon reserves

(Million 42-gallon barrels unless otherwise specified)

Zone	Dry natural gas (billion cubic feet)	Liquid hydrocarbons				
		Crude oil	Condensate	Dry natural gas liquid equivalent	1987 Total	1986 Total
1986 total	75,796	48,041	6,839	15,120	XX	70,000
1987:						
Marine (Bay of Campeche)	12,003	26,772	3,086	2,391	32,249	32,857
Chicontepec	26,692	10,905	1,320	5,339	17,564	17,530
Southeastern	23,219	7,173	1,943	4,624	13,740	14,034
Southern	1,130	795	69	226	1,090	1,109
Central	3,456	1,094	250	644	1,988	2,119
Northern	450	419	30	90	539	519
Northeastern Frontier	7,881	18	236	1,576	1,830	1,832
Total	74,831	47,176	6,934	14,890	69,000	XX

XX Not applicable.

Source: Petróleos Mexicanos, Memoria de Labores, 1986 and 1987.

The Mineral Industry of Morocco

By Kevin Connor[1]

Except for the chemical fertilizer sector, the mining industry was stagnant at best during 1987. Total export receipts from minerals fell by 16% below that of 1986 owing to downturns in antimony, copper, and zinc production, as well as the fall in the U.S. dollar in which phosphates were internationally traded. Phosphate rock exports and derivative chemical fertilizers continued to be by far Morocco's biggest mineral export commodity. Chemical fertilizers were the one bright spot in the minerals sector with output of phosphoric acid increasing 52% and five fertilizer products increasing between 10% and 78%.

The mining industry continued to be a healthy contributor to the Moroccan economy despite depressed international sales, accounting for 45% of all export receipts and employing more than 65,000 Moroccan citizens. Overall 1987 trade figures showed a 6% increase in export and import growth held to 2.5% when compared with 1986 levels, indicating a resilient economy despite lower phosphate prices and higher oil import costs.

Government Policies and Programs.—Government officials continued with plans to privatize many of the state's Bureau de Recherches et de Participations Minières (BRPM) mining operations in hopes of revitalizing the slumping industry. Impending closures of many of the country's small unprofitable metal mines, and strictly enforced austerity measures limiting the Government's spending for the industry, led mining officials in 1987 to seriously consider the encouragement of foreign participation in the country's nonfuel mineral industries for the first time. The metal and coal mining sectors were expected to be prime candidates for privatization efforts.

PRODUCTION AND TRADE

Production of most minerals decreased in 1987 when compared with 1986 levels. Barite was down 29%; antimony, 28%; copper, 21%; coal, 18%; and zinc, 18%. Phosphate mining decreased slightly. Some areas, such as iron and manganese, showed minor improvement.

Fertilizer products from phosphate rock conversion were up considerably, as the fertilizer complex at Jorf Lasfar became fully functional. For the first time, diammonium phosphate was produced at Jorf Lasfar in 1987. Plans were already under way to double the size of the Jorf Lasfar fertilizer complex, which was already one of the largest complexes of its kind in the world. More than 7 million tons of phosphate rock was used in the manufacture of chemical fertilizers. Still easily ranked as possessing the world's largest reserve base for phosphate rock, Morocco's agency for phosphate developments, Office Cherifien des Phosphates (OCP) was determined to continue with its aggressive long-term plans for the

industry.

Moroccan cement sales rose by 5.4% over those of 1986 to 3.9 million tons. Of the nine cement plants operating during the year, Cimenterie de l'Oriental remained the top supplier with 23.5% of the total market. Cimenterie d'Agadir, whose sales fell by almost 2% for the year, was the second-largest supplier of cement with 21.1% of the market. The largest market gains were made by the Cimenterie Nouvelle de Casablanca complex, which increased its sales by 31% over those of 1986. Imports of coal and coke rose 24% in 1987 to more than 1 million tons, compared with 817,000 tons in 1986 and 448,200 tons in 1985.

The Government was continuing its program to convert public facilities over to coal from oil, a program precipitated by the oil crisis period of the late 1970's and early 1980's. The main consumer of coal in 1987 was the Office National de Electricité, which used 599,200 tons, an increase of 28% over that of 1986. All of the country's cement plants used coal in 1987, a combined total of 373,100 tons. The major supplier of the imported coal was the United States, which sold Morocco 458,315 tons for the year. Colombia was the only other major supplier, with imports from that country at 270,379 tons for the year.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[p]
METALS					
Antimony concentrate:					
Gross weight	1,008	2,209	1,749	1,468	1,058
Sb content	454	972	750	617	444
Cobalt concentrate:					
Gross weight	--	--	--	--	2,113
Co content	--	--	--	--	224
Copper:					
Concentrate, gross weight	71,020	65,470	61,804	58,707	46,251
Cu content, concentrates and matte	2,544	1,361	2,481	1,347	1,416
Matte, gross weight	25,396	22,093	22,014	20,172	16,552
Iron and steel:					
Iron ore:					
Gross weight	173,010	162,984	190,528	195,600	210,200
Fe content	105,536	101,050	118,000	123,228	128,100
Metal:					
Pig iron[e]	15,000	15,000	15,000	15,000	15,000
Steel, crude[e]	6,000	6,000	6,000	6,000	6,000
Lead:					
Concentrate:					
Gross weight	139,796	143,890	152,549	104,398	105,090
Pb content	97,857	100,723	106,784	76,211	75,665
Metal:					
Smelter, primary only[e]	55,200	46,100	59,500	60,000	62,500
Refined:					
Primary	55,173	46,054	59,470	60,000	6,497
Secondary	2,000	2,000	2,000	2,000	2,000
Total[e]	57,173	48,054	61,470	62,000	64,497
Manganese ore, largely chemical-grade	73,515	56,786	43,690	40,334	42,500
Silver, mine output, Ag content[e] thousand troy ounces	2,850	2,410	2,733	1,566	1,410
Zinc concentrate:					
Gross weight	14,610	20,247	27,153	24,344	19,874
Zn content[e]	7,500	10,700	14,700	13,100	10,300
INDUSTRIAL MINERALS					
Barite	288,414	561,321	500,000	189,881	143,503
Cement, hydraulic thousand tons	3,848	3,588	3,694	3,742	3,800
Clays, crude:					
Bentonite	4,096	1,825	2,877	3,834	2,948
Fuller's earth (smectite)	27,385	33,406	24,425	35,100	46,271
Montmorillonite (ghassoul)	6,037	3,382	4,656	4,313	4,981
Feldspar[e]	1,000	1,000	1,000	1,000	1,000
Fluorspar, acid-grade	60,300	65,900	74,350	83,000	78,000
Gypsum[e]	440,000	450,000	450,000	450,000	450,000
Mica[e]	500	[3]1,200	[3]1,440	1,500	1,500
Mineral water[e] cubic meters	74,827	70,000	70,000	70,000	70,000
Phosphate rock (includes Western Sahara) thousand tons	20,106	21,245	20,737	21,178	20,955
Salt, rock	69,800	62,740	92,263	96,514	107,838

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[p]
MINERAL FUELS AND RELATED MATERIALS					
Coal, anthracite ---------- thousand tons	751	838	774	775	634
Gas, natural:					
Gross[e] ---------- million cubic feet	2,800	2,700	2,600	2,600	2,600
Marketed[e] ---------- do	2,200	2,100	2,000	2,000	2,000
Petroleum:					
Crude[e] ---------- thousand 42-gallon barrels	280	270	260	260	260
Refinery products:					
Gasoline -- thousand 42-gallon barrels	[3]9,490	9,500	9,500	9,500	9,500
Jet fuel ---------- do	[3]3,285	3,300	3,300	3,300	3,300
Kerosene ---------- do	[3]1,460	1,500	1,500	1,500	1,500
Distillate fuel oil ---------- do	[3]730	750	750	750	750
Residual fuel oil ---------- do	[3]2,190	2,100	2,100	2,100	2,100
Other ---------- do	[3]1,460	1,500	1,500	1,500	1,500
Refinery fuel and losses ---------- do	[3]13,140	13,000	13,000	13,000	13,000
Total ---------- do	[3]31,755	31,650	31,650	31,650	31,650

[e]Estimated. [p]Preliminary.

[1]Includes data available through June 30, 1988.

[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. Limestone quarried for cement manufacture is substantial; however, information is inadequate to make accurate estimates of output levels.

[3]Reported figure.

Table 2.—Morocco: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Scrap ----------	931	1,235	--	Belgium-Luxembourg 491; France 340; Japan 130.
Unwrought ----------	--	131	--	All to France.
Semimanufactures ----------	--	53	--	Italy 51.
Chromium: Ore and concentrate ----------	--	994	--	All to West Germany.
Copper:				
Ore and concentrate ----------	60,615	61,509	--	Spain 42,058; West Germany 9,752; East Germany 9,699.
Matte and speiss including cement copper ----------	2,524	1,169	--	All to Belgium-Luxembourg.
Metal including alloys:				
Scrap ----------	2,361	1,934	--	France 629; Belgium-Luxembourg 587; United Kingdom 234.
Semimanufactures ----------	3	--	--	
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite ----------	450	337	--	All to France.
Pyrite, roasted ----------	161,673	119,701	--	Spain 31,855; Switzerland 30,531; Tunisia 25,046.
Metal:				
Scrap ----------	80,690	52,087	--	Spain 47,931; Italy 2,915.
Pig iron, cast iron, related materials ----------	1,100	--		
Semimanufactures:				
Bars, rods, angles, shapes, sections ----------	13	6	--	Mali 5; Guinea 1.
Universals, plates, sheets --	17	83	--	All to Guinea.
Hoop and strip ----------	36	3	--	France 2; Italy 1.
Tubes, pipes, fittings ----------	48	88	--	Libya 45; Mali 26; France 14.
Castings and forgings, rough	--	11	--	All to Tunisia.

See footnote at end of table.

Table 2.—Morocco: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Lead:				
Ore and concentrate	60,366	35,243	--	Belgium-Luxembourg 13,479; Greece 12,839; U.S.S.R. 3,119.
Metal including alloys:				
Scrap	38	--		
Unwrought	55,893	55,679	--	Italy 28,862; Spain 5,213; Netherlands 4,301.
Semimanufactures	2	--		
Manganese: Metal including alloys, scrap	15	8	--	All to Netherlands..
Manganese: Ore and concentrate, metallurgical-grade	47,012	50,738	298	France 20,990; Italy 9,650; United Kingdom 6,445.
Nickel: Metal including alloys, unwrought	--	12	--	All to Netherlands.
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$11,669	$7,602	--	France $5,431; Switzerland $1,691.
Tungsten: Ore and concentrate	9	--		
Zinc:				
Ore and concentrate	30,816	28,789	--	Belgium-Luxembourg 12,630; France 6,919; West Germany 6,065.
Metal including alloys:				
Scrap	6	19	--	All to Spain.
Unwrought	--	18	--	All to Portugal.
Semimanufactures	24	50	--	All to France.
Other:				
Ores and concentrates	2,496	1,384	--	Belgium-Luxembourg 879; France 169; Yugoslavia 159.
Ashes and residues	4,154	974	--	France 719; Italy 108.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	2	--		
Asbestos, crude	297	919	--	All to Tunisia.
Barite and witherite	487,982	257,381	27,000	Norway 100,149; Trinidad and Tobago 24,250.
Cement	--	3,028	NA	Spain 1,123; unspecified 1,905.
Chalk	--	15	--	All to Senegal.
Clays, crude	33,777	33,012	--	Spain 20,960; United Kingdom 5,785; Italy 3,750.
Feldspar, fluorspar, related materials	64,686	79,944	22,500	West Germany 18,746; Norway 16,198.
Fertilizer materials: Manufactured:				
Ammonia	--	9	--	All to Libya.
Nitrogenous	500	--		
Phosphatic	604,720	563,052	--	U.S.S.R. 260,103; China 87,093; East Germany 60,800.
Potassic	500	--		
Unspecified and mixed	170,100	138,972	--	Hungary 49,617; Spain 28,734; Italy 16,360.
Gypsum and plaster	144,856	186,407	23	Japan 37,000; Spain 33,868; Ivory Coast 31,436.
Lime	92	--		
Mica, crude including splittings and waste	1,330	1,508	--	All to France.
Phosphates, crude thousand tons	14,790	13,696	38	Spain 2,430; Belgium-Luxembourg 1,456; Poland 1,351.
Pigments, mineral: Iron oxides and hydroxides, processed	4	--		
Salt and brine	26,630	28,400	--	All to United Kingdom.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	1,350	3,683	31	Spain 1,978; Italy 1,291; Austria 103.
Worked	12	65	15	United Arab Emirates 39; France 4.
Gravel and crushed rock	43,239	54,306	NA	Spain 40,678; unspecified 13,628.
Quartz and quartzite	2,500	3,500	--	All to Italy.
Sand other than metal-bearing	9,511	11,297	--	Spain 9,326; unspecified 1,971.
Sulfur:				
Elemental:				
Crude including native and by-product	5	258	--	Spain 252.

See footnotes at end of table.

Table 2.—Morocco: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur —Continued				
Elemental —Continued				
Colloidal, precipitated, sublimed	10	--		
Sulfuric acid	104	20	--	All to Gabon.
Talc, steatite, soapstone, pyrophyllite	--	210	--	France 150; Portugal 60.
Other: Crude	150	--		
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	--	5	--	All to West Germany.
Coal: Anthracite and bituminous	62,433	49,534	--	France 32,446; United Kingdom 15,513.
Petroleum refinery products:				
Gasoline, motor thousand 42-gallon barrels	1,985	1,960	--	Netherlands 1,713; France 178.
Kerosene and jet fuel ---do---	308	279	--	All for ship stores.
Distillate fuel oil ---do---	14	13	--	Do.
Lubricants ---do---	167	93	--	Libya 32; France 31; Netherlands 29.
Residual fuel oil ---do---	9	15	NA	NA.

NA Not available.
[1]Table prepared by Virginia A. Woodson.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals value, thousands	$2	--		
Aluminum:				
Ore and concentrate	3,200	4,000	--	French Guiana 2,000; Guyana 2,000.
Oxides and hydroxides	2,149	2,080	1	France 1,940; United Kingdom 63.
Metal including alloys:				
Scrap	89	66	--	All from West Germany.
Unwrought	1,017	1,645	--	Netherlands 1,250; France 206.
Semimanufactures	4,527	4,755	(2)	France 1,886; Spain 1,301; Italy 499.
Chromium:				
Ore and concentrate	--	203	--	Zimbabwe 198.
Oxides and hydroxides	14	17	--	West Germany 14; France 2.
Cobalt: Oxides and hydroxides	1	--		
Columbium and tantalum: Metal including alloys, all forms, tantalum value, thousands	$1	$8	--	All from Austria.
Copper: Metal including alloys:				
Scrap	14	9	--	All from France.
Unwrought	664	605	--	France 452; Italy 103.
Semimanufactures	11,666	9,853	1	France 4,944; Belgium-Luxembourg 1,901; United Kingdom 886.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	75	1,077	--	Spain 992; Norway 75.
Pyrite, roasted	12	--		
Metal:				
Scrap	2,167	3,300	--	Greece 2,000; United Kingdom 1,000.
Pig iron, cast iron, related materials	1,192	1,022	--	France 343; Brazil 270; Belgium-Luxembourg 268.
Ferroalloys:				
Ferromanganese	125	127	--	France 55; Belgium-Luxembourg 49; West Germany 23.
Unspecified	274	165	--	France 73; West Germany 64; Belgium-Luxembourg 12.
Steel, primary forms	336,413	257,629	--	Spain 93,935; Netherlands 55,075; West Germany 45,053.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections	105,442	68,217	(3)	Spain 35,390; France 11,953; Italy 6,486.
Universals, plates, sheets	(4)	123,649	70	France 35,942; West Germany 34,927; Spain 23,160.
Hoop and strip	13,274	12,624	--	France 7,489; Spain 2,329.
Rails and accessories	25,127	1,963	--	France 1,916.
Wire	22,782	11,911	(2)	France 3,989; Belgium-Luxembourg 3,626; Spain 2,331.
Tubes, pipes, fittings	23,426	10,068	9	West Germany 3,015; France 2,841; Spain 2,082.
Castings and forgings, rough	96	157	3	France 100; Italy 37.
Lead:				
Ore and concentrate	1,650	--		
Oxides	668	1,098	--	France 851; Spain 184.
Metal including alloys:				
Unwrought	362	1,901	--	Belgium-Luxembourg 1,537; France 300.
Semimanufactures	75	93	--	Netherlands 30; Portugal 21; West Germany 20.
Magnesium: Metal including alloys:				
Unwrought value, thousands	$2	--		
Semimanufactures	(2)	5	--	All from France.
Manganese:				
Ore and concentrate, metallurgical-grade	106	515	--	Gabon 385; Belgium-Luxembourg 130.
Oxides	721	485	--	Ireland 300; Belgium-Luxembourg 185.
Mercury 76-pound flasks	319	87	--	Turkey 58; Spain 29.
Molybdenum: Metal including alloys, all forms value, thousands	$9	$19	--	France $11; Netherlands $5.
Nickel:				
Matte and speiss	5	9	--	All from Canada.
Metal including alloys:				
Unwrought	41	25	--	France 12; Canada 8; Zimbabwe 4.
Semimanufactures	745	379	(2)	West Germany 215; Switzerland 100; Bulgaria 17.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$5	$2	--	All from France.
Silver: Metal including alloys, unwrought and partly wrought do	$100	$97	--	France $28; Italy $26; Switzerland $20.
Tin: Metal including alloys:				
Unwrought	156	158	--	Netherlands 52; Belgium-Luxembourg 30; Brazil 30.
Semimanufactures	12	14	--	France 3; Netherlands 3; Portugal 2.
Titanium: Oxides	2,166	1,956	--	France 1,113; Belgium-Luxembourg 705.
Tungsten:				
Ore and concentrate value, thousands	--	$7	--	All from West Germany.
Metal including alloys, all forms do	$12	$11	--	France $7; Austria $2.
Zinc:				
Oxides	564	640	--	France 269; Portugal 118; West Germany 99.
Metal including alloys:				
Scrap	--	20	--	All from Ivory Coast.
Unwrought	3,373	2,398	--	France 1,206; Belgium-Luxembourg 925.
Semimanufactures	261	273	--	France 137; West Germany 54; Romania 39.
Other:				
Ores and concentrates	268	179	--	All from Australia.
Oxides and hydroxides	90	404	10	Spain 242; West Germany 66; France 60.
Base metals including alloys, all forms	21	14	--	China 13; Switzerland 1.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	115	241	--	Italy 109; Spain 31; Turkey 25.
Artificial: Corundum	297	180	--	France 150; Spain 23.
Grinding and polishing wheels and stones	290	317	(2)	Italy 95; France 76; Denmark 57.
Asbestos, crude	1,110	4,991	(2)	Canada 2,848; Republic of South Africa 1,975.
Barite and witherite	--	32	22	France 10.
Boron materials:				
Crude natural borates	61	2	--	Belgium-Luxembourg 1; France 1.
Oxides and acids	19	14	--	Italy 7; France 6.
Cement	35,119	38,258	--	Spain 29,062; France 8,546.
Chalk	868	922	--	France 651; Spain 215.
Clays, crude	14,247	14,602	--	France 8,947; United Kingdom 4,323.
Cryolite and chiolite				
value, thousands	$10	$2	--	All from Switzerland.
Diatomite and other infusorial earth	52	98	--	France 62; West Germany 22.
Feldspar, fluorspar, related materials	751	358	--	France 238; Spain 120.
Fertilizer materials:				
Crude, n.e.s	1,041	20	--	All from Chile.
Manufactured:				
Ammonia	80,787	84,087	--	U.S.S.R. 66,007; Libya 6,021; Trinidad and Tobago 6,005.
Nitrogenous	236,756	373,490	20	Romania 123,476; Belgium-Luxembourg 64,670; Bulgaria 41,417.
Phosphatic value, thousands	--	$1	--	All from West Germany.
Potassic	98,216	88,127	--	Spain 44,705; East Germany 19,852; U.S.S.R. 11,483.
Unspecified and mixed	1,170	1,125	--	Belgium-Luxembourg 577; West Germany 281; Spain 131.
Graphite, natural	28	5	--	All from France.
Gypsum and plaster	(2)	8	--	All from Spain.
Lime	--	1,150	--	All from France.
Magnesium compounds: Magnesite, crude	49	120	--	Austria 100; Spain 18.
Mica:				
Crude including splittings and waste	6	7	--	France 5; Norway 2.
Worked including agglomerated splittings	2	3	--	France 2; Spain 1.
Pigments, mineral: Iron oxides and hydroxides, processed	1,238	1,142	--	West Germany 660; Spain 242; United Kingdom 115.
Precious and semiprecious stones other than diamond: Natural				
value, thousands	--	$9	--	France $5; Spain $2.
Salt and brine	32	7	--	West Germany 4; France 3.
Sodium compounds, n.e.s.: Sulfate, manufactured	610	2,583	--	France 2,572.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	59	803	--	Italy 799.
Worked	2,913	2,084	--	Portugal 1,053; Italy 605; Spain 405.
Dolomite, chiefly refractory-grade	139	326	--	France 241; Spain 85.
Gravel and crushed rock	280	669	--	Spain 534; France 23.
Quartz and quartzite	674	527	--	Belgium-Luxembourg 482; Italy 36.
Sand other than metal-bearing	26,698	18,412	--	Belgium-Luxembourg 15,738; Portugal 2,250.
Sulfur:				
Elemental, crude including native and byproduct thousand tons	1,469	1,672	493	Canada 852; Poland 318.
Sulfuric acid	52,486	33,415	--	Spain 28,895; Italy 4,514.
Talc, steatite, soapstone, pyrophyllite	1,060	1,080	--	France 1,027; United Kingdom 36.
Other: Crude	20,114	16,068	--	France 8,117; West Germany 5,778; Spain 1,973.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	--	1	--	All from France.
Carbon black	4,846	5,396	3	Spain 3,598; Netherlands 807.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coal: Anthracite and bituminous	420,743	755,041	589,265	United Kingdom 47,302; Australia 43,930.
Coke and semicoke	30,274	21,461	--	West Germany 18,466; United Kingdom 2,995.
Petroleum:				
Crude thousand 42-gallon barrels	36,179	32,453	(2)	Iraq 8,080; Kuwait 6,711; U.S.S.R. 5,200.
Refinery products:				
Liquefied petroleum gas do	1,930	2,736	--	Spain 1,377; France 941; United Kingdom 192.
Gasoline do	55	63	(2)	Netherlands 46; Portugal 11.
Mineral jelly and wax do	49	109	--	Hungary 48; France 28; West Germany 26.
Kerosene and jet fuel do	(2)	1	--	All from Netherlands.
Distillate fuel oil do	(2)	--		
Lubricants do	39	55	1	France 28; Venezuela 7; Belgium-Luxembourg 6.
Residual fuel oil do	213	(2)	--	All from Italy.
Bitumen and other residues do	(2)	(2)	(2)	Mainly from France.
Bituminous mixtures do	(2)	(2)	--	Do.

[1]Table prepared by Virginia A. Woodson.
[2]Less than 1/2 unit.
[3]Unreported quantity valued at $17,000.
[4]Unreported quantity valued at $67,432,000.

COMMODITY REVIEW

METALS

BRPM continued to conduct an extensive exploration program in the Guemassa area south of Marrakech, which was considered to have tremendous potential for polymetallic sulfide deposits, a situation first identified from results of preliminary geophysical studies completed in 1985. Within this area, the Douar Lahjar Prospect was estimated to contain 16 million tons of ore grading 9.5% zinc, 2.8% lead, and 0.9% copper. Under an agreement with The Broken Hill Proprietary Ltd. of Australia (BHP), in another area south of Marrakech within the Tekna Mountains, BHP was expected to conduct a 250-square-kilometer survey for polymetallic deposits. The company was targeting for lead-zinc mineralizations in its program, which was budgeted at $2.5 million[2] for a 3-year period.

INDUSTRIAL MINERALS

In recent years, Morocco's phosphate monopoly, OCP, has concentrated on two key aspects of developing the country's phosphate reserves: for additional reserves to replace or augment existing mine operations and for development of reserves within new mine environments. Following extensive exploration activities, OCP has been able to reassess its phosphate rock resources. It reported estimated reserves to exceed 56 billion tons. Approximately one-half of this total was accounted for in the Oulad Abdoun Plateau of the Khouribga District. The other major reserve area was Meskala, with more than 35% of the country's estimated reserves.

During 1987, OCP operated phosphate mines in four regions of Morocco. Two open pit mines were active on the Oulad Abdoun Plateau within the Khouribga mining district. Five underground mines were also operated within the Khouribga District. Situated on the Ganntour Plateau, the Youssoufia mining district had two underground mines producing white rock and two underground mines producing black rock. The Ben Guerir Mine on the northern edge of the Ganntour Plateau, which was commissioned in 1980, produced rock concentrate in 1987 for the chemical fertilizer industry at Safi. A fourth active phosphate-producing area was the Bu Craa Mine in northern Western Sahara.

OCP's new phosphate chemical fertilizer complex at Jorf Lasfar was essentially fully

operational by yearend. The complex was the largest of its kind in the world with eight identical Rhône-Poulenc S.A. phosphoric acid lines, having a combined capacity of 1.32 million tons per year of phosphoric acid. The lines were split into two groups of four lines each, designated Moroc Phosphore III and IV. Each group had its own control room and operating management. Centralized power, water, and melted sulfur facilities served both groups. A new railroad delivered phosphate rock from Khouribga to four storage halls, each with a capacity of 50,000 tons. There were six sulfuric acid lines, each with a rated capacity of 2,300 tons per day for supplying acid for digestion, using the Monsanto Enviro-Chem double-absorption process. Imported sulfur was melted at a 12,960-ton-per-day plant at the seaport, approximately 3 kilometers from the chemical fertilizer complex. Storage facilities for the melted sulfur included three 15,000-ton tanks at the melting plant and a tank farm halfway between the port and plant with a dozen 18,000-ton tanks.

MINERAL FUELS

Coal.—Expansion of Morocco's only coal mine, situated at Jerada in the Oujda Province, continued throughout the year. The expansion program was to sink a 1,000-meter vertical shaft and then implement mechanization of the mining. Longwall mining of the dipping anthracite coal seams was expected to get under way by 1989. Montan Consulting, a subsidiary of Ruhrkohle AG of the Federal Republic of Germany, was managing the project. Considering the projected needs for coal in Morocco, the demand for coal could far outstrip the expected 1 million tons per year production of the Jerada anthracite mine after completion of the expansion program. Therefore the Government agency for coal activities, Charbonnages de Maroc, and the BRPM were conducting exploration and delineation of lignite deposits in the Jerada area throughout 1987.

Natural Gas.—Exploration efforts for natural gas continued to be more successful than the search for oil. A new gas find was reported in the Garb area in 1987. Development of the Meskala gasfield to supply energy requirements of the Youssoufia phosphate mining and processing operations was under way throughout most of the year.

Petroleum.—Petroleum exploration efforts decreased in 1987, mainly owing to the depressed state of international petroleum prices. International firms either relinquished exploration rights or announced plans to do so. Pennzoil of the United States announced it would relinquish its exploration acreage in the Hauts Plateaux area of the Atlas Mountains early in 1988. Pennzoil had signed an agreement for the 5,000-square-kilometer concession in July 1985. Control of its 50% share in the concession was to revert to Morocco's exploration agency Office Nationale de Recherches et d'Exploitation des Pétroles (ONAREP). Other international firms were seriously considering cutbacks or pulling out altogether. To reverse the exodus of international petroleum firms, and improve incentives for companies to increase exploration activities, ONAREP was developing a revised petroleum code to be introduced in 1988. ONAREP planned to drill 10 exploration wells in 1988, 4 more than in 1987. It also expected to carry out considerable more exploration seismic work, with assistance from Canadian and Japanese firms.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Moroccan dinars (DH) to U.S. dollars at the rate of DH8.30=US$1.00.

The Mineral Industry of Namibia

By George A. Morgan[1]

The mining sector was the most important earner of foreign exchange, accounting for an estimated 85% of total exports in 1987. Output of the major mineral commodities, diamond and uranium, increased, while production from base metal mines declined. Tsumeb Corp. Ltd. (TCL) experienced production losses because of strikes by the new Mineworkers Union of Namibia (MUN) and severe falls of rock in two mines, which prevented the restart of full copper production for several months.

Mining and quarrying accounted for 36% or $467.7 million of the gross domestic product (GDP) of $1,294.9 million[2] in 1986, the latest year for which data are available, compared with 18% for general government, 11% for wholesale and retail trade, and 8% for agriculture and fishing. The mining and quarrying component of the GDP consisted of $208 million from uranium mining, $204.4 million from diamond mining, and $55.3 million from other mining.

Revenue collected by the Central Revenue Fund to administer the country amounted to $772 million for the year ended March 17, 1987. Of this amount, taxes on income from diamond mines were $41.7 million and from other mines $70.9 million; the diamond export duty was $24.4 million. The Government of the Republic of South Africa contributed $227.8 million of the total revenue collected.

Expenditures on exploration were $10.1 million in 1987 compared with $8.1 million in 1986. The Department of Economic Affairs issued 197 new prospecting licenses compared with 172 in 1986; registered 580 new claims, compared with 804 in 1986; and issued 29 new prospecting grants, compared with 22 in 1986.

Employment reported by the Chamber of Mines (CM) was 12,905 in 1987, compared with 14,428 the previous year. Total cash paid to these employees was $89.4 million in 1987 and $72.9 million in 1986. Consolidated Diamond Mines (Pty.) Ltd. (CDM) was the largest employer with 5,357 employees, followed by TCL with 3,861 employees, and Rossing Uranium Ltd.'s uranium mine with 2,495 employees. An illegal strike by more than 3,000 employees at TCL on July 27 lasted 1 month and ended in the dismissal of all striking workers. MUN, which was seeking to organize TCL workers, accepted a grant of access to the mine for recruitment purposes on December 15, 1987. The South West Africa Mine Workers' Union (SWAMU) entered into negotiations with TCL for a recognition agreement. The SWAMU's membership included 58% of employees in skilled categories.

Government.—A 60-member national assembly had the right to pass new laws and amend existing legislation. New procedures were implemented for regulating claims and prospecting grants and for transferring titles to mineral rights to third parties. Scrutiny of title transfers increased in order to prevent the lockup of potentially economic mineralization.

A white paper entitled "National Mineral Policy of South West Africa/Namibia" was published by the Department of Civic Affairs and Manpower. The paper set forth the Government's intention to control, regulate, and monitor all aspects of the minerals industry, including prospecting, mining, processing, and marketing, as well as pollution and restoring mine sites. Mineral rights remain vested with the Government, while development would continue to be undertaken by private industry. A Depart-

ment of Mines would be established, and the Government would derive income from a profit-based tax system rather than through rentals, levies, royalties, or surcharges. Capital expenditures, including exploration costs, would continue to be written off against income. The Government, or a parastatal acting in its behalf, would have the right to purchase up to 15% of the shareholding of any mining venture at market price. A National Unit Trust would hold these shares, and in turn, make them available to the general public and to financial and commercial institutions registered in Namibia. Export permits would be required for all minerals, and would be compared with the comprehensive returns required of all mineral producers and the audits of mineral consignments.

PRODUCTION AND TRADE

The Government Mining Engineer reported the production of 34 mineral commodities from 46 mining operations. The CM, which represented the mining industry before the Government and on numerous national bodies, had 30 members at yearend 1987.

Detailed trade data for sources and destinations of imports and exports in 1987 were unavailable. Namibian trade data are included with data for the Republic of South Africa, which is part of the Customs Union and includes Botswana, Lesotho, and Swaziland.

Mineral exports in 1986, the latest year for which data are available, accounted for $725.3 million or 83% of total merchandise exports of $877.6 million. Diamonds alone accounted for $271.3 million. Agricultural exports were $67.8 million, and manufactured exports totaled $35.2 million. Total merchandise imports for 1986 were $652 million. Exports of minerals to the United States in 1987 totaled about $200,000 and consisted of arsenic trioxide, salt, quartzite, cadmium, zinc, and granite in descending order of value. Mineral imports from the United States were only 226 tons of nitrogenous fertilizer. Most imports of food, fuel, chemicals, and equipment were from the Republic of South Africa, brought in primarily by railroad. Chemicals for metallurgical extraction were imported, although sulfuric acid was produced as a byproduct of copper and uranium mining.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Antimony, Sb content of sodium antimonate	--	--	--	--	[3]32
Arsenic, white[4]	1,126	2,504	2,471	2,208	[3]1,864
Cadmium metal, refined	51	40	58	61	[3]51
Columbium and tantalum:					
Concentrate, gross weight kilograms	2,800	6,600	4,600	[e]5,000	5,000
Copper:					
Mine output, Cu content of concentrate	50,447	47,406	48,036	49,591	[3]37,557
Metal, blister	54,238	46,436	43,295	45,688	[3]35,488
Gold, Au content of smelter products troy ounces	7,459	6,302	6,237	5,916	[3]5,530
Lead:					
Mine output, Pb content of concentrate	38,467	33,255	34,640	37,494	[3]32,997
Metal, refined	35,416	28,930	38,511	40,047	[3]40,634
Silver: Mine output, Ag content of concentrate thousand troy ounces	3,535	3,255	3,404	3,472	[3]3,320
Tin, mine output, Sn content of concentrate	[e]1,400	906	984	710	1,097
Uranium, U_3O_8 content of concentrate	[e]4,450	4,400	4,400	3,990	[3]4,175
Zinc, mine output, Zn content of concentrate	33,526	32,195	30,232	35,371	40,600
INDUSTRIAL MINERALS					
Diamond:[5]					
Gem[e] thousand carats	915	884	865	970	970
Industrial[e] do	48	46	45	40	50
Total do	963	930	910	1,010	[3]1,020
Lime	600	--	--	--	--
Limestone and marble	15,400	23,400	31,600	32,000	32,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Lithium minerals:					
Amblygonite	50	60	50	52	[3]106
Lepidolite	30	20	110	52	[3]53
Petalite	700	800	1,800	1,116	[3]750
Total	780	880	1,960	1,220	[3]909
Mica	100	90	--	--	--
Quartz	150	20	300	851	[3]2,173
Salt	136,900	88,000	152,300	130,000	124,000
Sulfur, S content of pyritic concentrate	80,719	104,454	107,718	133,824	[3]74,354
Wollastonite	1,100	--	373	--	--

[e]Estimated. [p]Preliminary.

[1]Table includes data available through June 22, 1988.

[2]Data are compiled from the annual report of the Chamber of Mines of South West Africa/Namibia and from operating company annual reports as follows: Tsumeb Corp. Ltd. (TCL), South African Iron and Steel Industrial Corp. Ltd. (Iscor), Falconbridge Nickel Mines Ltd., Rio Tinto Zinc Corp. Ltd. (RTZ), and others as available.

[3]Reported figure.

[4]White arsenic equivalent of all arsenic products reported as being produced.

[5]Total figures reported by De Beers Consolidated Mines Ltd. in company annual reports for calendar years. Details on gem and industrial diamonds are estimates, assuming output to be 95% gem quality.

COMMODITY REVIEW

METALS

In addition to the mineral commodities listed in table 1, a number of minerals were produced for which published statistics were limited. Among these were agate, amethyst, aragonite, beryl, dioptase, gypsum, rose quartz, silica, sodalite, and tourmaline.

Antimony.—Antimony output commenced as a byproduct of TCL's lead refinery with the commissioning of a sodium antimonate recovery plant. Some metallurgical problems remained to be resolved, but the 51 tons of sodium antimonate produced contained 32 tons of antimony and reportedly met market specifications.

Copper.—The Klein Aub Mine closed permanently owing to declining ore grade and an unfavorable exchange rate. The closure was precipitated by an illegal stay away by lower skilled members of the work force. About 3,000 tons of productive capacity of copper in concentrates was lost with its closure.

At the Tsumeb Mine of TCL, a stope collapse in the upper production levels on March 13 sharply curtailed cut-and-cement-fill operations. By yearend, monthly output was about 47% of that planned. Mill throughput was also reduced owing to the strike, resulting in about 2 months of lost production and underdelivery of concentrates to the smelter. The loss was partly compensated for by increasing the copper grade to 3.05% from 2.92% and by commissioning part of a gravity-separation plant. Total copper recovery increased 1.1% as a result of the commissioning. Ore classification equipment remained to be installed to complete the plant. Smelter production of blister copper at Tsumeb dropped sharply to 35,488 tons in 1987 from 50,145 tons in 1986. The reverberatory furnace completed 6 years of continuous operation; extensive repairs in 1987 were expected to permit an additional 2 years of operation. The No. 2 blast furnace was shut down late in the year.

Ore output at the Otjihase Mine fell by more than 300,000 tons from the 1986 level, owing to a roof failure in April. Underground truck haulage access was severed to 80% of the stoping areas and to the crusher grizzly. By yearend, monthly output was about 75% of that planned. Blister copper output from Otjihase concentrates, which were shipped to O'okiep Copper Co. Ltd. in the Republic of South Africa, was 2,165 tons, less than one-half of the 1986 level.

Output of ore and concentrate from the Kombat Mine and mill declined owing to the presence of harder, more siliceous ore from the Asis West ore body. An additional rod mill and ball mill were installed at a cost of about $300,000, and commissioned in November, increasing capacity by 40%.

Copper reserves for TCL as of December 31, 1987, including positive, probable, and tentative reserves, totaled 16.4 million tons

averaging 2.71% copper. Of this amount, the Tsumeb Mine accounted for 4.5 million tons grading 3.13% copper; the Kombat Mine, 3.8 million tons grading 2.9% copper; and the Otjihase Mine, 8.1 million tons grading 2.38% copper.

Gold.—Sufficient reserves were established at the Navachab gold deposit to permit establishment of a mine owned by Anglo Amrican Corp. Startup was planned for October 1989, with an initial output of 63,000 tons per month and ore grades of about 0.08 troy ounce per ton. Mine life was estimated to be at least 13 years and expected capital costs for the project were about $43.3 million. Processing would be by carbon-in-pulp and cyanidation. Water for the project, and for the nearby towns of Karabib and Usakos, would be transported 85 kilometers by pipeline from the Swakkoppoort Dam. Total employment would be about 200.

Lead.—Lead concentrate from the Pering Mine in the Republic of South Africa was sold to Gold Fields of South Africa Ltd.'s Tsumeb smelter in Namibia under a 3-year contract. Approximately 9,000 tons per year of lead concentrate, grading 65% to 68% lead, would be available for sale from Pering. Prices would be based on London Metal Exchange prices. Pering concentrates were shipped 1,600 kilometers by rail to the Tsumeb smelter at a cost of $48 per ton.

The Tsumeb mill produced almost 52,000 tons of lead concentrate grading 24.56% lead. Smelter output was 40,634 tons, of which 13,087 tons was from TCL mines and the remainder was from other sources, including the Pering Mine in the Republic of South Africa. Lead sales totaled 41,537 tons and were valued at about $22 million. Total reserves at the Tsumeb and Kombat Mines were 8.2 million tons, averaging 1.27% lead.

Zinc.—The African Exploration Group acquired the Deblin lead and zinc mine near Swakopmund. No information was reported on development plans or mine data.

Table 2.—Namibia: Gross weight and elemental content of ore and concentrate produced in 1987, by mine

(Metric tons unless otherwise specified)

Mine or mill	Gross weight	Elemental content				
		Copper	Lead	Zinc	Sulfur	Silver (troy ounces)
Asis East:						
Ore	5,108	73	81	--	NA	2,299
Concentrate:						
Copper	385	55	32	--	NA	1,857
Lead	6	1	2	--	NA	7
Asis West:						
Ore	176,188	8,968	1,797	--	NA	203,924
Concentrate:						
Copper	28,159	8,428	1,481	--	NA	194,646
Lead	180	16	92	--	NA	--
Klein Aub:						
Ore[e]	7,300	150	--	--	NA	--
Concentrate: Copper	263	113	--	--	NA	--
Kombat:						
Ore	143,857	3,582	2,302	--	NA	111,002
Concentrate:						
Copper	10,430	2,967	867	--	NA	96,911
Lead	2,379	266	1,205	--	NA	8,949
Otjihase:						
Ore	546,863	11,047	--	--	101,388	NA
Concentrate:						
Copper	38,328	10,467	--	--	13,238	8,949
Pyrite	120,260	192	--	--	61,116	--
Rosh Pinah:						
Ore[e]	475,000	--	14,250	38,000	NA	NA
Concentrate:						
Lead	20,684	--	8,604	[e]950	NA	514,411
Zinc	70,244	--	4,650	37,556	NA	640,000
Slag mill:						
Ore (slag)	215,970	2,800	NA	NA	NA	NA
Concentrate: Copper	6,252	1,173	353	NA	NA	46,030
Tsumeb:						
Ore	514,756	15,700	18,994	5,868	NA	1,952,872
Concentrate:						
Copper	38,464	10,013	2,983	--	NA	1,087,184
Lead	51,826	3,866	12,728	2,094	NA	639,837
Total:						
Ore	XX	38,738	37,424	43,868	101,388	NA
Concentrate	XX	37,557	32,997	40,600	74,354	3,319,788

[e]Estimated. NA Not available. XX Not applicable.

INDUSTRIAL MINERALS

Diamond.—CDM continued construction of its new diamond-sorting center in Windhoek. Diamonds currently shipped to the Republic of South Africa for sorting will remain in Namibia to be sorted. The company reopened its No. 3 crushing and treatment plant for additional ore processing, and production was up as prices for diamond improved.

Fluorspar.—Fluorspar was reported as being mined at Okorusu, and output was to be shipped through Walvis Bay. The mine was privately owned and was located about 130 kilometers southwest of Tsumeb. Operating data were not available.

Marble.—The Marble Corp. (Marcor) expected to commence production of various colored marble from its deposits between Aus and Rosh Pinah in July 1988. Marcor was to be listed on the Johannesburg Stock Exchange in March. Output was to reach 20,000 cubic meters per year by 1990. Marble would be trucked to Aus and then railed to Walvis Bay for export mainly to Italy and other European countries. About 83% of production would be exported.

MINERAL FUELS

The United Nations Council for Namibia attempted to halt enrichment of uranium ore produced by the Rossing Mine at the Almelo facility in the Netherlands. However, a complicating factor was that ore reaching the facility was often partially upgraded and blended with other ores.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from South African rands (R) to U.S. dollars at the rate of R1 = US$0.4406 for 1986 and R1 = US$0.4856 for 1987.

The Mineral Industry of the Netherlands

By Don Buck[1]

The rate of growth in the gross national product of the Netherlands slowed to 1.5% in 1987, largely as a result of the global realignment of monetary values. Devaluation of the U.S. dollar and deterioration of the price of exported gas were factors in a reduction of approximately 50% in the Netherlands foreign trade surplus, which dropped to $3.4 billion.[2] Revenues from gas exports, traditionally a significant source of Government income, dropped to $2.5 billion, a 67% decline since the record high of $7.4 billion in 1985.[3] Investment in petroleum exploration and production reflected a similar drop in 1987 as companies adjusted to changed monetary values and to decreased product prices. Other mineral-related industries in the Netherlands, such as the processing of metals and chemicals, showed no change in trade surpluses. Export prices were reduced, partly because raw material costs were down, but also so that companies in the Netherlands could remain competitive in the international market.

The unemployment rate in the Netherlands was 12.5%, one of the highest rates in the European Economic Community, despite Government attempts to foster economic growth and reduce the burden of social programs on the national economy. Government spending increased 8% to $13.3 billion, and Government outlays constituted 60% of the gross domestic product or 7.6% of the national income.[4]

PRODUCTION

Manufacturing production grew at the slow rate of 1% and recorded one of the worst performances in recent years.[5] International competition and appreciation in value of the guilder were major factors in the reduction of export revenues, especially to the United States and other nations linked to the declining dollar. The declining rate of business investment was partly offset by strong increases in the chemical industry (up 9%) and basic metal industry (up 7%), reflecting lower import costs in raw materials and the stronger value of the guilder. Investment by businesses slowed as a wait-and-see attitude developed toward the world trade and exchange rates. This condition was expected to carry over into 1988.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986	1987[p]
METALS					
Aluminum:					
Primary	235,351	249,170	250,603	265,768	275,939
Secondary	58,199	59,894	62,315	96,794	101,403
Cadmium metal	513	636	598	565	517
Iron and steel:					
Ore sintered (from imported ore) thousand tons	2,669	3,516	3,737	3,706	3,682
Metal:					
Pig iron do.	3,747	4,926	4,819	4,628	4,575
Steel, crude do.	4,477	5,739	5,517	5,283	5,082
Semimanufactures do.	4,066	4,928	4,868	4,799	4,709
Lead: Refined:					
Primary	2,000				
Secondary[e]	[3]23,600	[r]25,000	[r]25,000	33,000	40,000
Total	25,600	[r]25,000	[r]25,000	33,000	[e]40,000
Tin, refined:					
Primary	5,398	6,517	6,033	5,104	3,834
Secondary[e]	180	180	204	200	180
Zinc (slab), primary	187,519	209,657	201,712	196,156	207,111
INDUSTRIAL MINERALS					
Cement, hydraulic thousand tons	3,107	3,176	2,911	3,100	2,929
Nitrogen: N content of ammonia do.	1,747	2,312	2,386	2,185	2,287
Salt, all types do.	3,124	3,674	4,154	3,763	3,979
Sand, industrial do.	19,399	[e]19,000	19,988	22,841	22,274
Sodium compounds, n.e.s.:[e]					
Carbonate do.	420	400	380	380	380
Sulfate, synthetic do.	50	45	45	45	45
Sulfur:					
Elemental byproduct:[e]					
Of metallurgy do.	100				
Of petroleum and other forms do.	105	245	250	250	245
Total do.	205	245	250	250	245
Sulfuric acid, 100% H_2SO_4 do.	1,420	1,609	1,508	1,209	956
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	91,200	102,300	103,000	104,700	105,500
Coke thousand tons	2,126	2,726	2,971	2,867	2,736
Gas:					
Manufactured, all types[4] million cubic feet	288,445	298,631	266,056	271,918	325,489
Natural, gross do.	2,702,792	2,728,041	2,850,581	2,614,543	2,621,959
Natural gas liquids thousand 42-gallon barrels	3,608	3,818	4,221	4,221	4,278
Peat[e] thousand tons	400	450	450	400	400
Petroleum:					
Crude thousand 42-gallon barrels	17,647	21,143	27,734	34,046	29,243
Refinery products:					
Gasoline, motor do.	60,597	56,568	53,049	60,189	62,254
Jet fuel do.	28,288	28,968	27,800	30,808	31,120
Kerosene do.	4,487	4,487	3,550	4,658	3,891
Distillate fuel oil do.	107,461	120,039	111,303	147,305	133,549
Residual fuel oil do.	103,743	102,744	85,901	85,901	92,154
Lubricants do.	3,423	[e]3,500	5,544	5,117	[e]5,000
Liquefied petroleum gas do.	21,912	[e]22,000	22,562	25,230	27,457
Naphtha do.	67,737	63,784	50,133	65,986	75,944
Bitumen do.	4,375	[e]4,500	4,242	5,048	4,545
Total[5] do.	402,023	406,590	364,084	430,242	[3]435,914

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

[1]Table includes data available through Sept. 1988.

[2]In addition to the commodities listed, a variety of crude construction materials (clays, gravel, and stone) are also produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

[4]Coke oven and blast furnace gas only.

[5]Total of listed products only; refinery fuel and losses included with listed products.

TRADE

The Netherlands, situated at the intersection of the Rhine, Europe's major river, and the sealanes of the North Atlantic, has prospered on trading and distribution of products. With limited local mineral resources on which to build an industrial economy, the Port of Rotterdam has become the world's busiest seaport, importing raw material for refinement and distribution of goods. Rotterdam's strategic location was reflected in the estimates that Netherlands barges carry almost one-half of all inland water freight on the European Continent, and that Netherlands truckers carry one-fourth of the international freight carried on European roads. The Port of Rotterdam handled 100 million tons more cargo than the second busiest seaport in the world and more than the next three European ports combined.

The Netherlands trade volume increased by 4% in 1987, with exports valued at $92.3 billion and imports at $89.7 billion. The United States generated its greatest trade surplus, about $4 billion, in trading with the Netherlands. The proportion of U.S. exports going to the Netherlands rose from 8% to 8.4%, while the Netherlands proportion of U.S. imports dropped slightly to 4%.

Table 2.—Netherlands: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	2	1	--	Mainly to United Kingdom.
Alkaline-earth metals	--	10		All to West Germany.
Aluminum:				
Ore and concentrate	5,063	3,983	--	Belgium-Luxembourg 2,560; Norway 224; Sweden 216.
Oxides and hydroxides	59,175	46,493	--	West Germany 13,104; United Kingdom 11,272; France 4,929.
Ash and residue containing aluminum	11,371	10,863	--	West Germany 7,132; Spain 2,655; France 441.
Metal including alloys:				
Scrap	87,062	96,045	--	West Germany 50,695; Belgium-Luxembourg 18,104; France 17,717.
Unwrought	296,767	301,260	2,332	Belgium-Luxembourg 118,999; France 83,951; West Germany 54,561.
Semimanufactures	109,418	121,245	7,160	West Germany 48,560; Belgium-Luxembourg 18,232; France 15,105.
Antimony:				
Ore and concentrate	1	--		
Oxides	243	220	NA	West Germany 94; Italy 68; France 37.
Metal including alloys, all forms	59	7	--	NA.
Arsenic: Oxides and acids	10	--		
Beryllium:				
Oxides and hydroxides	--	(2)	NA	NA.
Metal including alloys, all forms	(2)	1	--	Mainly to Belgium-Luxembourg.
Bismuth: Metal including alloys, all forms	12	27	--	France 12; West Germany 12.
Cadmium: Metal including alloys, all forms	615	541	32	France 290; United Kingdom 87; West Germany 75.
Cesium and rubidium: Metal including alloys, all forms	(2)	(2)	--	Mainly to France.
Chromium:				
Ore and concentrate	27,379	30,070	--	West Germany 10,776; France 7,589; Belgium-Luxembourg 3,623.
Oxides and hydroxides	421	408	(2)	West Germany 171; Italy 119; France 43.
Metal including alloys, all forms	2	75	--	NA.

See footnotes at end of table.

Table 2.—Netherlands: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Cobalt:				
Ore and concentrate	25	(2)	NA	NA.
Oxides and hydroxides	48	78	20	West Germany 30; Turkey 6.
Metal including alloys, all forms	286	35	--	United Kingdom 19; Belgium-Luxembourg 7; West Germany 2.
Columbium and tantalum:				
Ore and concentrate	154	4	--	All to West Germany.
Ash and residue containing columbium and/or tantalum	1	249	--	Do.
Metal including alloys, all forms:				
Columbium (niobium)	(2)	1	(2)	Mainly to United Kingdom.
Tantalum	2	28	--	Spain 27.
Copper:				
Matte and speiss including cement copper	20	310	--	Spain 303; Belgium-Luxembourg 7.
Oxides and hydroxides	115	112	--	West Germany 22; Norway 20; United Arab Emirates 20.
Sulfate	2,048	1,834	--	Belgium-Luxembourg 854; West Germany 422; United Kingdom 355.
Ash and residue containing copper	8,946	6,387	41	Belgium-Luxembourg 3,057; West Germany 2,622; India 260.
Metal including alloys:				
Scrap	73,072	63,208	--	West Germany 30,357; Belgium-Luxembourg 19,209; Italy 7,058.
Unwrought	9,462	6,066	73	West Germany 4,589; France 857; Sweden 215.
Semimanufactures	59,723	59,615	16,622	West Germany 11,694; Belgium-Luxembourg 5,710.
Germanium: Metal including alloys, all forms	1	(2)	--	All to West Germany.
Gold:				
Waste and sweepings value, thousands	$17,161	$18,391	$420	West Germany $14,753; Spain $1,232; Switzerland $941.
Metal including alloys, unwrought and partly wrought troy ounces	62,236	42,756	24	Switzerland 12,314; Denmark 10,288; Belgium-Luxembourg 8,842.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	55,044	47,659	--	West Germany 39,179; France 3,173; Algeria 1,696.
Pyrite, roasted	159	108	--	West Germany 79; Austria 28.
Metal:				
Scrap thousand tons	1,835	1,992	1	India 506; West Germany 397; Belgium-Luxembourg 251.
Pig iron, cast iron, related materials	18,451	18,512	279	West Germany 10,024; United Kingdom 4,115; Belgium-Luxembourg 3,670.
Ferroalloys:				
Ferrochromium	1,714	14,881	--	West Germany 9,216; Belgium-Luxembourg 4,972; France 396.
Ferromanganese	154	103	--	West Germany 77; Belgium-Luxembourg 26.
Ferromolybdenum	289	532	--	Italy 182; France 154; West Germany 109.
Ferronickel	92	13	--	NA.
Ferrosilicochromium	--	25	--	All to France.
Ferrosilicomanganese	--	285	--	Belgium-Luxembourg 248.
Ferrosilicon	230	2,730	--	Japan 1,882; West Germany 715; Belgium-Luxembourg 107.
Silicon metal	2,052	2,147	--	France 1,131; West Germany 995.
Unspecified	1,043	2,634	32	West Germany 979; Sweden 803; Czechoslovakia 178.
Steel, primary forms thousand tons	2,239	2,225	240	Belgium-Luxembourg 321; West Germany 260; Greece 241.

See footnotes at end of table.

Table 2.—Netherlands: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections thousand tons	511	534	14	West Germany 201; Belgium-Luxembourg 147; China 36.
Universals, plates, sheets do	1,712	1,787	167	West Germany 413; Belgium-Luxembourg 360; United Kingdom 212.
Hoop and strip do	131	144	(2)	West Germany 59; Switzerland 37; Spain 10.
Rails and accessories do	38	25	(2)	Italy 20; West Germany 4.
Wire do	68	68	2	Belgium-Luxembourg 16; West Germany 14; France 11.
Tubes, pipes, fittings do	490	428	17	West Germany 117; Belgium-Luxembourg 65; United Kingdom 48.
Castings and forgings, rough do	18	19	(2)	Belgium-Luxembourg 6; West Germany 6; United Kingdom 4.
Lead:				
Oxides	6,607	5,633	--	West Germany 3,838; United Kingdom 547; Yugoslavia 358.
Ash and residue containing lead	7,031	3,524	2	France 1,278; West Germany 977; Belgium-Luxembourg 940.
Metal including alloys:				
Scrap	20,213	17,203	--	West Germany 6,380; France 6,233; Belgium-Luxembourg 2,663.
Unwrought	20,051	20,369	--	West Germany 16,267; Belgium-Luxembourg 1,474; France 966.
Semimanufactures	2,779	2,597	--	Norway 859; Belgium-Luxembourg 495; United Kingdom 416.
Lithium:				
Oxides and hydroxides	27	18	NA	France 12; West Germany 3.
Metal including alloys, all forms	--	(2)	--	All to West Germany.
Magnesium: Metal including alloys:				
Scrap	1,705	1,168	18	West Germany 723; Italy 190; France 150.
Unwrought	4,911	6,207	46	West Germany 3,699; United Kingdom 1,236; France 786.
Semimanufactures	108	14	1	Belgium-Luxembourg 9; West Germany 3.
Manganese:				
Ore and concentrate, metallurgical-grade	47,849	41,166	--	West Germany 9,842; Belgium-Luxembourg 2,686; France 2,333.
Oxides	216	88	17	Saudi Arabia 50; Sri Lanka 19.
Metal including alloys, all forms	1,830	1,241	--	Norway 243; France 212; West Germany 191.
Mercury 76-pound flasks	725	667	--	West Germany 145; Belgium-Luxembourg 116; Romania 87.
Molybdenum:				
Ore and concentrate	18,224	13,699	5	United Kingdom 4,079; Austria 2,409; West Germany 1,900.
Oxides and hydroxides	1,509	945	17	Austria 650; United Kingdom 117; Belgium-Luxembourg 76.
Metal including alloys:				
Scrap	15	14	--	All to West Germany.
Unwrought	53	11	--	Spain 9; West Germany 2.
Semimanufactures	206	195	3	Belgium-Luxembourg 113; France 26; Japan 20.
Nickel:				
Matte and speiss	1,693	2,211	NA	NA.
Ash and residue containing nickel	2,491	1,849	--	Austria 391; West Germany 344; Australia 298.
Metal including alloys:				
Scrap	3,196	4,811	--	Finland 4,091; West Germany 455; India 68.
Unwrought	443	500	--	Belgium-Luxembourg 62; Republic of South Africa 52; Portugal 41.
Semimanufactures	271	360	9	West Germany 157; Belgium-Luxembourg 40; Italy 36.

See footnotes at end of table.

Table 2.—Netherlands: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Platinum-group metals:				
Waste and sweepings value, thousands	$18,672	$27,104	--	West Germany $10,049; Belgium-Luxembourg $7,302; France $6,249.
Metals including alloys, unwrought and partly wrought troy ounces	71,585	58,916	1,204	West Germany 32,297; France 8,074; United Kingdom 3,042.
Rare-earth metals including alloys, all forms	(2)	(2)	--	Mainly to West Germany.
Rhenium: Metal including alloys, all forms	(2)	(2)	--	All to Spain.
Selenium, elemental	3	2	--	NA.
Silicon, high-purity	--	4	--	NA.
Silver:				
Waste and sweepings value, thousands	$6,733	$8,753	--	West Germany $3,855; United Kingdom $2,417; Spain $1,904.
Metal including alloys, unwrought and partly wrought thousand troy ounces	4,281	4,900	NA	West Germany 1,528; Greece 925; Italy 677.
Tellurium, elemental and arsenic	89	44	--	West Germany 20; France 10; Switzerland 6.
Tin:				
Ore and concentrate	--	223	--	U.S.S.R. 162; United Kingdom 61.
Oxides	20	9	--	Belgium-Luxembourg 6; West Germany 3.
Ash and residue containing tin	1,100	1,320	18	Belgium-Luxembourg 863; West Germany 255; United Kingdom 184.
Metal including alloys:				
Scrap	224	174	--	Belgium-Luxembourg 101; United Kingdom 42; West Germany 23.
Unwrought	2,128	3,205	40	West Germany 1,468; France 467; United Kingdom 301.
Semimanufactures	991	1,146	--	West Germany 516; Belgium-Luxembourg 233; France 153.
Titanium:				
Ore and concentrate	30,664	35,733	--	France 5,536; U.S.S.R. 5,000; Romania 4,975.
Oxides	3,536	3,823	--	Italy 1,866; West Germany 154; unspecified 1,687.
Metal including alloys:				
Scrap	32	25	--	United Kingdom 14; West Germany 11.
Unwrought	5	11	--	United Kingdom 10.
Semimanufactures	36	25	(2)	Libya 12; Belgium-Luxembourg 7; West Germany 2.
Tungsten:				
Ore and concentrate	1,166	97	--	Czechoslovakia 62; United Kingdom 21; Austria 12.
Ash and residue containing tungsten	65	47	--	West Germany 37; Austria 10.
Metal including alloys:				
Scrap	291	271	148	West Germany 89; United Kingdom 33.
Unwrought	21	20	--	West Germany 11; France 3; United Kingdom 3.
Semimanufactures	211	219	26	Belgium-Luxembourg 128; West Germany 23.
Uranium and/or thorium: Metal including alloys, all forms, thorium	(2)	(2)	NA	NA.
Vanadium:				
Oxides and hydroxides	--	(2)	NA	NA.
Ash and residue containing vanadium	52	67	--	United Kingdom 36; Belgium-Luxembourg 25; West Germany 6.
Metal including alloys, semimanufactures	(2)	(2)	--	All to West Germany.

See footnotes at end of table.

Table 2.—Netherlands: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Zinc:				
Ore and concentrate	--	130	--	All to West Germany.
Blue powder	903	655	--	Belgium-Luxembourg 370; France 147; Saudi Arabia 59.
Matte	3,093	3,582	--	West Germany 2,859; Belgium-Luxembourg 216; France 201.
Ash and residue containing zinc	17,599	13,968	796	West Germany 4,760; Belgium-Luxembourg 3,794; France 3,615.
Metal including alloys:				
Scrap	10,544	11,924	34	West Germany 5,747; Belgium-Luxembourg 3,873; France 1,298.
Unwrought	181,400	181,706	21,060	West Germany 40,847; France 29,560; United Kingdom 26,996.
Semimanufactures	6,091	5,980	--	West Germany 3,501; France 1,503; Belgium-Luxembourg 621.
Zirconium:				
Ore and concentrate	40,008	36,548	--	West Germany 21,996; U.S.S.R. 3,750; France 3,737.
Metal including alloys:				
Scrap	19	(2)	--	NA.
Semimanufactures	(2)	(2)	--	Mainly to France.
Other:				
Ores and concentrates	375	108	--	United Kingdom 44; Belgium-Luxembourg 24; Norway 20.
Oxides and hydroxides	24	120	NA	West Germany 41; Spain 25; Italy 11.
Ashes and residues	3,242	2,695	77	Finland 1,042; West Germany 453; United Kingdom 391.
Base metals including alloys, all forms	2	2	(2)	West Germany 1; France 1.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	8,137	6,451	(2)	Belgium-Luxembourg 1,321; Thailand 1,112; United Kingdom 541.
Artificial: Corundum	131	98	--	West Germany 36; Belgium-Luxembourg 32; France 16.
Dust and powder of precious and semiprecious stones including diamond kilograms	77	110	2	United Kingdom 24; West Germany 21; Belgium-Luxembourg 16.
Grinding and polishing wheels and stones	5,341	6,446	10	West Germany 1,783; United Kingdom 1,339; France 835.
Asbestos, crude	50	177	--	East Germany 95; West Germany 47; Belgium-Luxembourg 29.
Barite and witherite	64,442	42,091	143	United Kingdom 17,773; West Germany 8,603; Denmark 6,855.
Boron materials:				
Crude natural borates	37,362	30,498	NA	West Germany 2,930; Australia 1,564; unspecified 22,322.
Oxides and acids	731	1,049	6	West Germany 390; Czechoslovakia 128; Finland 108.
Bromine	2,030	616	--	France 282; West Germany 184; Belgium-Luxembourg 69.
Cement	502,736	440,305	1,659	Belgium-Luxembourg 182,733; West Germany 156,404; United Kingdom 40,861.
Chalk	21,385	22,102	3	Belgium-Luxembourg 20,970; West Germany 1,022; Netherlands Antilles 38.
Clays, crude:				
Bentonite	30,572	30,405	--	West Germany 8,471; Belgium-Luxembourg 7,727; Nigeria 2,780.
Chamotte earth	2,761	611	--	Belgium-Luxembourg 486; West Germany 74; Denmark 35.
Fuller's earth	301	575	--	West Germany 306; Belgium-Luxembourg 94.

See footnotes at end of table.

Table 2.—Netherlands: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Clays, crude —Continued				
Kaolin	119,020	132,208	--	Belgium-Luxembourg 94,530; West Germany 32,192; France 2,156.
Unspecified	r103,055	97,135	--	West Germany 58,767; Belgium-Luxembourg 34,060; Sweden 1,419.
Cryolite and chiolite	2	--		
Diamond:				
Gem, not set or strung carats	373,231	392,617	56,305	Belgium-Luxembourg 147,033; Switzerland 136,033.
Industrial stones do	762,316	1,183,953	234,993	Belgium-Luxembourg 285,605; Hong Kong 263,607.
Diatomite and other infusorial earth	1,796	486	--	Belgium-Luxembourg 196; Singapore 41; France 38.
Feldspar, fluorspar, related materials:				
Feldspar	1,421	1,114	--	France 905; West Germany 76; Trinidad and Tobago 60.
Fluorspar	224	408	--	India 219; Belgium-Luxembourg 140; West Germany 24.
Unspecified	18,163	16,138	--	West Germany 9,898; Belgium-Luxembourg 2,973; Italy 1,574.
Fertilizer materials:				
Crude, n.e.s	130,153	140,541	--	Belgium-Luxembourg 106,922; West Germany 27,539; France 5,577.
Manufactured:				
Ammonia thousand tons	1,095	927	--	Belgium-Luxembourg 419; West Germany 229; United Kingdom 178.
Nitrogenous do	3,768	3,076	243	France 1,049; West Germany 823; United Kingdom 416.
Phosphatic do	342	353	--	United Kingdom 141; France 118; West Germany 44.
Potassic do	7	11	(2)	Belgium-Luxembourg 5; United Kingdom 3; Egypt 1.
Unspecified and mixed do	1,044	1,113	--	France 263; West Germany 192; unspecified 382.
Graphite, natural	89	87	9	West Germany 49; France 14.
Gypsum and plaster	42,153	53,662	--	Belgium-Luxembourg 47,652; West Germany 2,790; United Kingdom 2,760.
Iodine	14	12	--	Cuba 3; China 2; Iran 2.
Kyanite and related materials	2,164	2,531	--	West Germany 1,921; France 291; Norway 70.
Lime	13,163	4,685	--	Belgium-Luxembourg 2,457; West Germany 1,214; Italy 450.
Magnesium compounds:				
Magnesite, crude	1,049	1,618	--	West Germany 948; Belgium-Luxembourg 501; France 69.
Oxides and hydroxides	34,042	109,775	74	West Germany 18,996; France 3,154; unspecified 76,873.
Other	760	424	--	Belgium-Luxembourg 249; West Germany 131; Austria 24.
Mica:				
Crude including splittings and waste	1,458	1,001	--	Nigeria 150; Norway 123; Egypt 120.
Worked including agglomerated splittings	4	1	--	Mainly to Belgium-Luxembourg.
Nitrates, crude	424	234	--	West Germany 114; Belgium-Luxembourg 113; Ireland 7.
Phosphates, crude	57,174	21,876	--	France 11,882; West Germany 9,526; Belgium-Luxembourg 450.
Pigments, mineral:				
Natural, crude	51	64	--	France 32; Belgium-Luxembourg 22; United Kingdom 7.
Iron oxides and hydroxides, processed	6,611	5,467	807	West Germany 1,758; France 1,005.
Potassium salts, crude	108	107	--	West Germany 99.
Precious and semiprecious stones other than diamond:				
Natural kilograms	2,436	2,713	NA	West Germany 1,043; Belgium-Luxembourg 660.
Synthetic do	748	1,929	--	Mainly to Japan.

See footnotes at end of table.

Table 2.—Netherlands: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Pyrite, unroasted	--	13	--	Sweden 10; France 3.
Quartz crystal, piezoelectric kilograms	11	--		
Salt and brine thousand tons	2,863	2,685	--	Belgium-Luxembourg 787; Ireland 8; unspecified 1,874.
Sodium compounds, n.e.s.: Carbonate, manufactured	162,749	159,668	--	West Germany 56,009; Belgium-Luxembourg 26,176; Denmark 13,438.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked thousand tons	10	13	(2)	West Germany 9; Belgium-Luxembourg 3.
Worked do	58	72	(2)	West Germany 42; Belgium-Luxembourg 28; Austria 1.
Dolomite, chiefly refractory-grade do	25	21	--	Belgium-Luxembourg 9; West Germany 8; United Kingdom 1.
Gravel and crushed rock do	2,634	2,682	(2)	Belgium-Luxembourg 2,431; West Germany 231; United Kingdom 13.
Limestone other than dimension do	1	(2)	--	Mainly to West Germany.
Quartz and quartzite do	14	13	(2)	West Germany 8; Austria 1; Belgium-Luxembourg 1.
Sand other than metal-bearing do	8,106	8,575	--	Belgium-Luxembourg 8,133; West Germany 346; United Kingdom 15.
Sulfur:				
Elemental:				
Crude including native and by-product	22,288	29,104	--	Belgium-Luxembourg 23,169; France 4,468; West Germany 1,466.
Colloidal, precipitated, sublimed	8	24	--	All to West Germany.
Dioxide	920	825	--	France 602; Belgium-Luxembourg 117; Ireland 94.
Sulfuric acid	158,899	193,997	1,995	West Germany 111,110; Belgium-Luxembourg 67,710; United Kingdom 5,028.
Talc, steatite, soapstone, pyrophyllite	7,762	8,817	17	West Germany 4,405; Belgium-Luxembourg 2,137; Italy 1,167.
Vermiculite, perlite, chlorite	371	476	--	West Germany 402.
Other:				
Crude	268,215	396,691	191	Belgium-Luxembourg 309,109; West Germany 54,355; France 12,773.
Slag and dross, not metal-bearing	612,181	769,666	2,058	Belgium-Luxembourg 395,581; United Kingdom 114,896; France 77,714.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,313	1,122	--	Belgium-Luxembourg 1,052; West Germany 63; Denmark 3.
Carbon:				
Carbon black	98,130	100,255	27	Belgium-Luxembourg 23,263; France 23,046; West Germany 20,464.
Gas carbon	4	1	--	All to Belgium-Luxembourg.
Coal:				
Anthracite thousand tons	322	215	--	Belgium-Luxembourg 160; Ireland 15; United Kingdom 15.
Bituminous do	1,463	2,166	--	United Kingdom 588; West Germany 401; Belgium-Luxembourg 281.
Briquets of anthracite and bituminous coal do	4	2	--	Mainly to Belgium-Luxembourg.
Lignite including briquets do	5	4	--	Belgium-Luxembourg 2; United Kingdom 2.

See footnotes at end of table.

Table 2.—Netherlands: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coke and semicoke thousand tons	995	928	--	Belgium-Luxembourg 416; France 270; West Germany 152.
Gas, natural: Gaseous million cubic feet	1,412,804	1,165,813	--	West Germany 630,516; France 195,176; Italy 176,026.
Peat including briquets and litter	281,842	301,057	14	Belgium-Luxembourg 105,665; France 93,217; West Germany 61,991.
Petroleum:				
Crude thousand 42-gallon barrels	9,053	9,286	--	Belgium-Luxembourg 5,510; United Kingdom 3,377; West Germany 344.
Refinery products:				
Liquefied petroleum gas do	8,185	7,460	60	Belgium-Luxembourg 2,779; West Germany 2,637; United Kingdom 764.
Gasoline do	77,810	86,777	6,800	West Germany 41,769; United Kingdom 11,195; Belgium-Luxembourg 11,084.
Mineral jelly and wax do	422	507	8	France 145; West Germany 129; United Kingdom 56.
Kerosene and jet fuel do	24,085	24,972	4,650	West Germany 13,487; United Kingdom 2,597; bunkers 2,296.
Distillate fuel oil do	112,474	134,340	(2)	West Germany 88,655; Belgium-Luxembourg 25,436; bunkers 6,186.
Lubricants do	4,793	4,565	228	Belgium-Luxembourg 923; Sweden 398; West Germany 342.
Residual fuel oil do	89,817	85,155	2,634	United Kingdom 14,350; West Germany 13,540; bunkers 34,013.
Bitumen and other residues do	1,531	2,329	--	West Germany 481; Belgium-Luxembourg 431; Norway 324.
Bituminous mixtures do	229	559	(2)	West Germany 462; Belgium-Luxembourg 62; United Kingdom 4.
Petroleum coke do	402	186	NA	NA.

[r]Revised. NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	138	107	--	West Germany 44; Sweden 30; United Kingdom 25.
Alkaline-earth metals	22	32	--	Canada 11; China 8; France 8.
Aluminum:				
Ore and concentrate	162,384	162,760	771	Greece 151,286; Guyana 5,250; China 4,295.
Oxides and hydroxides	589,116	641,585	694	Jamaica 281,547; Suriname 275,312; West Germany 42,105.
Ash and residue containing aluminum	13,073	13,348	--	West Germany 5,799; Belgium-Luxembourg 3,905; East Germany 1,174.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Aluminum —Continued				
Metal including alloys:				
Scrap	67,179	76,325	2,587	West Germany 25,671; Belgium-Luxembourg 13,950; United Kingdom 6,028.
Unwrought	135,210	151,131	276	Norway 49,919; West Germany 33,225; Romania 15,330.
Semimanufactures	124,017	134,472	2,845	West Germany 44,031; Belgium-Luxembourg 32,393; France 11,425.
Antimony:				
Ore and concentrate	5	--		
Oxides	1,115	1,125	15	Belgium-Luxembourg 366; France 346; United Kingdom 171.
Metal including alloys, all forms	99	64	8	Hong Kong 26; Spain 11.
Arsnic: Oxides and acids	107	95	--	United Kingdom 80; France 11; West Germany 2.
Beryllium:				
Oxides and hydroxides	(2)	--		
Metal including alloys, all forms	12	1	(2)	Mainly from West Germany.
Bismuth: Metal including alloys, all forms	46	21	NA	Belgium-Luxembourg 14; West Germany 1.
Cadmium: Metal including alloys, all forms	129	53	--	France 15; West Germany 13; United Kingdom 6.
Cesium and rubidium: Metal including alloys, all forms	(2)	1	--	All from West Germany.
Chromium:				
Ore and concentrate	40,239	38,247	--	Republic of South Africa 37,469; West Germany 713; Belgium-Luxembourg 30.
Oxides and hydroxides	1,879	1,545	375	West Germany 473; United Kingdom 238.
Metal including alloys, all forms	120	67	NA	France 37; China 10; United Kingdom 10.
Cobalt:				
Oxides and hydroxides	2	(2)	--	All from France.
Ash and residue containing cobalt	253	280	29	Belgium-Luxembourg 149; Finland 69.
Metal including alloys, all forms	177	66	2	United Kingdom 24; Spain 10; West Germany 7.
Columbium and tantalum:				
Ore and concentrate	93	--		
Metal including alloys, all forms:				
Columbium (niobium)	2	3	1	Brazil 1; United Kingdom 1.
Tantalum	5	1	(2)	Mainly from West Germany.
Copper:				
Ore and concentrate	236	308	--	All from Belgium-Luxembourg.
Matte and speiss including cement copper	26	257	--	West Germany 248; Belgium-Luxembourg 8.
Oxides and hydroxides	734	567	--	Italy 183; Norway 111; United Kingdom 103.
Sulfate	6,781	5,541	--	Belgium-Luxembourg 2,133; West Germany 1,286; Poland 873.
Ash and residue containing copper	4,072	2,232	21	West Germany 1,077; France 432; Cuba 163.
Metal including alloys:				
Scrap	62,001	57,512	2,346	West Germany 18,098; Belgium-Luxembourg 10,178; United Kingdom 6,411.
Unwrought	21,282	24,101	1,442	Canada 5,182; East Germany 3,607; West Germany 3,473.
Semimanufactures	97,448	97,979	261	West Germany 41,899; Belgium-Luxembourg 34,680; France 11,082.
Germanium: Metal including alloys, all forms	(2)	1	(2)	Mainly from West Germany.
Gold:				
Waste and sweepings value, thousands	$8,934	$5,696	--	Belgium-Luxembourg $2,887; Denmark $2,095; West Germany $551.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Gold —Continued				
Metal including alloys, unwrought and partly wrought _ troy ounces	188,688	162,009	4,083	United Kingdom 83,432; West Germany 40,189; Switzerland 12,598.
Hafnium: Metal including alloys, all forms	(2)	(2)	(2)	
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	8,507	7,066	--	Brazil 2,000; Sweden 1,343; Australia 1,026.
Pyrite, roasted do	1	(2)	--	Mainly from Belgium-Luxembourg.
Metal:				
Scrap	586,431	849,806	2,590	West Germany 442,746; United Kingdom 186,669; Belgium-Luxembourg 160,708.
Pig iron, cast iron, related materials	49,929	56,721	14	West Germany 17,851; Brazil 14,996; France 7,232.
Ferroalloys:				
Ferrochromium	2,798	16,083	NA	Albania 13,561; West Germany 858; Belgium-Luxembourg 641.
Ferromanganese	22,664	17,046	--	Norway 7,300; France 6,383; West Germany 2,525.
Ferromolybdenum	502	563	NA	United Kingdom 490; Austria 31.
Ferronickel	86	254	NA	West Germany 90; Taiwan 53; Portugal 44.
Ferrosilicochromium	61	95	NA	West Germany 50; Norway 20.
Ferrosilicomanganese	5,737	6,486	NA	Norway 2,150; Republic of South Africa 1,487; France 1,254.
Ferrosilicon	5,063	7,972	NA	West Germany 3,342; U.S.S.R. 2,735; Norway 841.
Silicon metal	4,736	4,313	--	West Germany 1,426; Brazil 1,101; Norway 656.
Unspecified	2,035	3,451	NA	U.S.S.R. 2,237; France 528; United Kingdom 234.
Steel, primary forms	456,100	468,347	139	West Germany 164,519; Belgium-Luxembourg 90,102; Italy 41,940.
Semimanufactures:				
Bars, rods, angles, shapes, sections _ thousand tons	1,302	1,428	(2)	Belgium-Luxembourg 496; West Germany 480; France 142.
Universals, plates, sheets do	1,120	1,136	1	Belgium-Luxembourg 477; West Germany 349; France 62.
Hoop and strip do	237	258	(2)	West Germany 157; Belgium-Luxembourg 58; France 19.
Rails and accessories do	57	40	(2)	West Germany 28; France 8; Belgium-Luxembourg 2.
Wire do	107	104	(2)	West Germany 48; Belgium-Luxembourg 34; France 9.
Tubes, pipes, fittings do	781	722	2	West Germany 395; France 84; Belgium-Luxembourg 61.
Castings and forgings, rough do	25	21	(2)	West Germany 12; Belgium-Luxembourg 4; United Kingdom 1.
Lead:				
Ore and concentrate	1	2	--	All from Belgium-Luxembourg.
Oxides	6,165	5,579	5	West Germany 4,725; Belgium-Luxembourg 676; France 160.
Ash and residue containing lead	2,529	1,332	--	West Germany 691; Belgium-Luxembourg 266; Finland 118.
Metal including alloys:				
Scrap	24,593	19,257	589	West Germany 10,653; Belgium-Luxembourg 2,352; United Kingdom 2,210.
Unwrought	35,509	36,910	66	Belgium-Luxembourg 16,740; West Germany 7,220; France 5,750.
Semimanufactures	8,600	9,452	14	Belgium-Luxembourg 7,849; West Germany 899; United Kingdom 659.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Lithium:				
Oxides and hydroxides	102	83	32	West Germany 30; U.S.S.R. 20.
Metal including alloys, all forms	11	1	--	All from West Germany.
Magnesium: Metal including alloys:				
Scrap	1,457	1,297	60	West Germany 372; France 119; Sweden 102.
Unwrought	6,310	8,243	6,659	Norway 1,439; France 45.
Semimanufactures	308	276	6	West Germany 85; Switzerland 52; United Kingdom 40.
Manganese:				
Ore and concentrate, metallurgical-grade	72,493	130,177	NA	Italy 1,297; West Germany 760; unspecified 127,850.
Oxides	160	269	220	Belgium-Luxembourg 37; West Germany 12.
Metal including alloys, all forms	2,113	2,004	346	Republic of South Africa 1,206; China 187.
Mercury 76-pound flasks	754	24,940	--	Finland 290; Belgium-Luxembourg 208; West Germany 174.
Molybdenum:				
Ore and concentrate	24,061	22,961	13,435	China 4,361; Chile 3,515.
Oxides and hydroxides	24	30	20	West Germany 10.
Metal including alloys:				
Scrap	2	4	--	All from France.
Unwrought	145	79	--	West Germany 78; Belgium-Luxembourg 1.
Semimanufactures	39	33	(2)	Belgium-Luxembourg 23; Austria 8; France 1.
Nickel:				
Ore and concentrate	3	4	--	All from France.
Matte and speiss	2,025	133,222	NA	NA.
Oxides and hydroxides	314	141	--	Belgium-Luxembourg 10; West Germany 7; unspecified 120.
Ash and residue containing nickel	1,774	1,498	123	West Germany 856; France 304.
Metal including alloys:				
Scrap	3,141	3,137	459	Canada 997; West Germany 577.
Unwrought	1,771	3,115	14	U.S.S.R. 1,884; Belgium-Luxembourg 237; Norway 120.
Semimanufactures	985	1,141	120	West Germany 403; United Kingdom 250; Belgium-Luxembourg 155.
Platinum-group metals:				
Waste and sweepings value, thousands	$1,414	$994	$1	Iran $391; Belgium-Luxembourg $317; Sweden $102.
Metals including alloys, unwrought and partly wrought troy ounces	91,186	86,268	20,702	West Germany 19,835; Switzerland 17,326.
Rare-earth metals including alloys, all forms	11	28	(2)	Austria 20; France 7.
Rhenium: Metal including alloys, all forms	11	9	1	Belgium-Luxembourg 5; West Germany 2; France 1.
Selenium, elemental	10	8	--	Canada 3; unspecified 5.
Silicon, high-purity	74	20	--	West Germany 18; Italy 2.
Silver:				
Waste and sweepings value, thousands	$1,656	$1,125	--	Belgium-Luxembourg $392; France $183; United Kingdom $182.
Metal including alloys, unwrought and partly wrought thousand troy ounces	3,771	5,075	177	West Germany 1,782; United Kingdom 858; Spain 780.
Tellurium, elemental and arsenic	96	37	(2)	Sweden 34; Belgium-Luxembourg 3.
Tin:				
Ore and concentrate	10,677	9,986	--	United Kingdom 5,505; Zaire 2,169; Burma 803.
Oxides	171	189	(2)	United Kingdom 88; France 47; West Germany 47.
Ash and residue containing tin	891	202	37	West Germany 64; Republic of South Africa 53.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Tin —Continued				
Metal including alloys:				
Scrap	455	355	--	West Germany 117; Italy 87; United Kingdom 56.
Unwrought	3,170	2,671	55	Belgium-Luxembourg 972; United Kingdom 763; West Germany 272.
Semimanufactures	307	202	(2)	United Kingdom 110; West Germany 68; Belgium-Luxembourg 10.
Titanium:				
Ore and concentrate	39,830	47,466	--	Sierra Leone 15,936; Australia 14,141; Republic of South Africa 9,731.
Oxides	6,892	5,823	96	West Germany 2,116; United Kingdom 1,311; France 964.
Metal including alloys:				
Scrap	38	63	35	United Kingdom 12.
Unwrought	53	65	--	U.S.S.R. 50; West Germany 15.
Semimanufactures	124	106	18	West Germany 45; United Kingdom 20.
Tungsten:				
Ore and concentrate	1,145	227	--	Portugal 206; United Kingdom 15; Hungary 5.
Oxides and hydroxides	7	5	--	West Germany 4; Italy 1.
Ash and residue containing tungsten	42	33	10	Sweden 12; West Germany 10.
Metal including alloys:				
Scrap	41	53	17	Sweden 25; United Kingdom 8.
Unwrought	378	563	491	West Germany 72.
Semimanufactures	32	45	4	Belgium-Luxembourg 30; West Germany 4.
Uranium and/or thorium:				
Ore and concentrate	--	18	--	All from Republic of South Africa.
Metal including alloys, all forms:				
Uranium	(2)	(2)	--	All from United Kingdom.
Thorium	(2)	19	--	All from West Germany.
Vanadium:				
Oxides and hydroxides	7	30	--	West Germany 21; Finland 6.
Ash and residue containing vanadium	1,028	1,957	--	Belgium-Luxembourg 1,950.
Metal including alloys:				
Scrap	--	(2)	(2)	
Unwrought	(2)	1	--	All from West Germany.
Semimanufactures	(2)	1	(2)	Mainly from West Germany.
Zinc:				
Ore and concentrate	444,706	396,439	--	Canada 110,643; Ireland 101,131; Australia 68,558.
Oxides	3,348	3,500	41	West Germany 1,554; France 491; Belgium-Luxembourg 356.
Blue powder	3,729	2,552	--	West Germany 1,269; Norway 621; Belgium-Luxembourg 423.
Matte	4,550	2,868	--	West Germany 1,446; Belgium-Luxembourg 864; France 498.
Ash and residue containing zinc	20,103	22,146	--	Belgium-Luxembourg 18,266; West Germany 2,397; Cuba 674.
Metal including alloys:				
Scrap	12,290	11,686	--	West Germany 5,022; Belgium-Luxembourg 4,257; United Kingdom 1,473.
Unwrought	22,229	26,477	--	Belgium-Luxembourg 10,484; West Germany 7,497; Finland 3,155.
Semimanufactures	5,794	5,406	(2)	West Germany 3,559; Belgium-Luxembourg 1,135; France 307.
Zirconium:				
Ore and concentrate	40,856	38,464	--	Australia 28,037; Republic of South Africa 8,487; India 1,589.
Metal including alloys:				
Scrap	15	7	--	West Germany 4; United Kingdom 2.
Unwrought	1	(2)	--	All from West Germany.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Other:				
Ores and concentrates	117	56	--	West Germany 38; Australia 18.
Oxides and hydroxides	180	209	21	Belgium-Luxembourg 67; West Germany 49; Spain 32.
Ashes and residues	42,330	50,240	80	Canada 45,157; West Germany 3,355; Belgium-Luxembourg 1,124.
Base metals including alloys, all forms	1	1	(2)	Mainly from Belgium-Luxembourg.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	370,845	279,716	20	West Germany 269,467; Belgium-Luxembourg 6,265; Turkey 1,750.
Artificial:				
Corundum	7,435	7,229	20	West Germany 5,273; France 722; Czechoslovakia 360.
Silicon carbide	1,471	2,064	8	West Germany 1,511; Norway 213; Belgium-Luxembourg 131.
Dust and powder of precious and semi-precious stones including diamond kilograms	239	189	NA	Belgium-Luxembourg 107; Switzerland 39; Ireland 37.
Grinding and polishing wheels and stones	3,329	4,836	62	France 1,707; West Germany 1,639; Austria 438.
Asbestos, crude	5,625	7,087	4	Canada 3,385; Greece 2,096; Italy 1,368.
Barite and witherite	94,843	62,341	--	China 30,442; Belgium-Luxembourg 17,191; Morocco 7,650.
Boron materials:				
Crude natural borates	52,957	32,019	10,160	Belgium-Luxembourg 10,981; Turkey 10,742.
Elemental	(2)	--		
Oxides and acids	1,988	2,353	807	France 731; Italy 312.
Bromine	807	7,627	--	Israel 7,506; United Kingdom 72; Belgium-Luxembourg 40.
Cement thousand tons	2,838	3,075	(2)	Belgium-Luxembourg 1,514; West Germany 1,509; Poland 26.
Chalk	103,313	97,268	--	France 51,486; West Germany 28,880; Belgium-Luxembourg 15,428.
Clays, crude:				
Bentonite	74,619	85,191	12,601	Greece 59,180; Italy 5,361.
Chamotte earth	19,022	21,246	6,113	West Germany 12,437; France 2,629.
Fuller's earth	3,455	4,882	400	West Germany 2,363; United Kingdom 969; Spain 454.
Kaolin	454,237	460,099	62,970	United Kingdom 177,618; West Germany 68,285; Spain 63,752.
Unspecified	r467,683	662,339	64	West Germany 625,715; France 12,179; United Kingdom 9,629.
Cryolite and chiolite	33	349	--	Denmark 276; France 25; Austria 24.
Diamond:				
Gem, not set or strung carats	662,107	494,179	30,519	Switzerland 289,628; Belgium-Luxembourg 82,939; Zaire 34,901.
Industrial stones do	567,090	1,130,572	242,643	United Kingdom 466,525; Belgium-Luxembourg 237,453.
Diatomite and other infusorial earth	64,815	77,143	2,281	Belgium-Luxembourg 60,082; Denmark 13,391.
Feldspar, fluorspar, related materials:				
Feldspar	20,167	19,749	--	Norway 13,070; West Germany 4,740; Italy 1,128.
Fluorspar	27,152	23,148	--	Spain 9,312; East Germany 9,157; West Germany 795.
Unspecified	44,018	39,094	--	Canada 29,028; Norway 9,216; West Germany 778.
Fertilizer materials:				
Crude, n.e.s	150,117	153,494	--	West Germany 129,560; Belgium-Luxembourg 20,672; Italy 2,359.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Fertilizer materials —Continued				
Manufactured:				
Ammonia	95,327	70,854	--	Trinidad and Tobago 11,986; United Kingdom 7,982; West Germany 4,934.
Nitrogenous	723,925	791,602	44	Belgium-Luxembourg 303,557; West Germany 224,244; France 73,286.
Phosphatic	154,660	185,433	--	Israel 77,070; Belgium-Luxembourg 42,314; West Germany 33,264.
Potassic	432,791	457,942	16,281	West Germany 127,831; Belgium-Luxembourg 67,780; U.S.S.R. 67,710.
Unspecified and mixed	271,522	224,485	926	Belgium-Luxembourg 83,373; West Germany 49,390; Israel 20,092.
Graphite, natural	636	1,204	--	China 616; West Germany 385; United Kingdom 116.
Gypsum and plaster	426,389	454,205	106	West Germany 207,612; France 120,880; Belgium-Luxembourg 84,030.
Iodine	458	376	1	Guatemala 10; Canada 4; unspecified 357.
Kyanite and related materials	11,818	9,876	199	Republic of South Africa 7,909; West Germany 1,357.
Lime	882,591	837,550	--	Belgium-Luxembourg 547,345; West Germany 289,848; France 237.
Magnesium compounds:				
Magnesite, crude	3,933	1,939	--	Greece 1,363; Italy 264; Belgium-Luxembourg 212.
Oxides and hydroxides	77,042	80,890	446	China 31,799; Greece 23,345; Austria 7,920.
Sulfate	36,779	34,555	--	West Germany 32,825; Belgium-Luxembourg 820; Greece 815.
Mica:				
Crude including splittings and waste	2,600	1,880	126	Canada 392; United Kingdom 355; India 343.
Worked including agglomerated splittings	50	60	5	Belgium-Luxembourg 34; Switzerland 12; Japan 5.
Nitrates, crude	24,634	26,864	--	Chile 17,456; Belgium-Luxembourg 9,317; West Germany 91.
Phosphates, crude thousand tons	2,388	2,053	493	Morocco 735; Israel 553.
Phosphorus, elemental	55	65	--	West Germany 63; United Kingdom 2.
Pigments, mineral:				
Natural, crude	139	393	--	Belgium-Luxembourg 215; Cyprus 143; Italy 30.
Iron oxides and hydroxides, processed	12,137	10,114	100	West Germany 8,374; United Kingdom 640; Italy 465.
Potassium salts, crude	2,708	3,757	--	West Germany 3,697; Belgium-Luxembourg 60.
Precious and semiprecious stones other than diamond:				
Natural kilograms	39,629	22,954	5,000	West Germany 7,469; Brazil 5,000.
Synthetic do.	9,482	7,469	NA	Japan 7,306; Belgium-Luxembourg 8; West Germany 3.
Pyrite, unroasted	204	243	--	West Germany 181; Belgium-Luxembourg 62.
Salt and brine	412,093	336,495	75	West Germany 97,619; Belgium-Luxembourg 85,402; France 51,053.
Sodium compounds, n.e.s.: Carbonate, manufactured	65,374	56,019	1	West Germany 51,450; Poland 1,984; East Germany 1,714.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked thousand tons	1,489	1,248	(2)	West Germany 696; Belgium-Luxembourg 500; France 16.
Worked do.	66	93	(2)	West Germany 36; Italy 32; Belgium-Luxembourg 8.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel —Continued				
Dolomite, chiefly refractory-grade thousand tons	939	852	--	Belgium-Luxembourg 732; United Kingdom 42; Norway 37.
Gravel and crushed rock ---do---	16,740	18,954	(2)	West Germany 10,894; Belgium-Luxembourg 6,145; France 1,369.
Limestone other than dimension do---	476	620	--	Belgium-Luxembourg 549; West Germany 59; France 12.
Quartz and quartzite-----do---	22	25	(2)	West Germany 14; Norway 8; Belgium-Luxembourg 3.
Sand other than metal-bearing do---	6,856	7,462	3	West Germany 5,433; Belgium-Luxembourg 1,719; Norway 288.
Sulfur:				
Elemental:				
Crude including native and byproduct ----------	377,044	289,455	2,259	West Germany 219,928; France 24,628; Belgium-Luxembourg 11,694.
Colloidal, precipitated, sublimed	603	213	--	United Kingdom 110; West Germany 103.
Dioxide----------	7,526	7,548	(2)	West Germany 6,735; Belgium-Luxembourg 498; France 315.
Sulfuric acid----------	566,884	591,579	(2)	West Germany 209,008; Finland 113,569; Belgium-Luxembourg 92,646.
Talc, steatite, soapstone, pyrophyllite --	42,241	46,910	194	France 12,224; Austria 6,075; West Germany 4,712.
Vermiculite, perlite, chlorite--------	9,146	5,676	--	Republic of South Africa 2,779; Greece 2,187; West Germany 545.
Other:				
Crude---------- thousand tons	1,442	1,043	8	West Germany 563; Belgium-Luxembourg 454.
Slag and dross, not metal-bearing do---	1,286	1,675	(2)	West Germany 1,057; Belgium-Luxembourg 617.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural -------	4,995	5,049	779	Belgium-Luxembourg 2,309; West Germany 1,817.
Carbon:				
Carbon black ----------	15,136	12,506	826	West Germany 9,004; United Kingdom 717.
Gas carbon ----------	1,520	1,413	115	West Germany 618; United Kingdom 618.
Coal:				
Anthracite------ thousand tons	388	344	7	Republic of South Africa 213; West Germany 112.
Bituminous ----------do---	11,106	11,944	4,857	Australia 4,073; Republic of South Africa 1,278.
Briquets of anthracite and bituminous coal----------do---	11	4	--	Mainly from West Germany.
Lignite including briquets --do---	150	132	--	West Germany 107; Belgium-Luxembourg 22; East Germany 3.
Coke and semicoke----------do---	525	577	29	United Kingdom 208; West Germany 201; Argentina 41.
Gas, natural-----million cubic feet	73,840	70,155	--	West Germany 70,112; France 43.
Peat including briquets and litter -----	746,901	761,861	--	West Germany 710,101; Finland 23,099; U.S.S.R. 9,725.
Petroleum:				
Crude thousand 42-gallon barrels	296,698	345,129	--	Saudi Arabia 71,872; United Kingdom 67,615; Norway 39,392.
Refinery products:				
Liquefied petroleum gas do---	24,743	21,400	(2)	United Kingdom 10,084; Algeria 4,371; Belgium-Luxembourg 2,840.
Gasoline ----------do---	46,921	41,712	108	U.S.S.R. 7,477; Algeria 7,279; Kuwait 4,930.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products —Continued				
Mineral jelly and wax thousand 42-gallon barrels	527	604	2	West Germany 201; France 123; Austria 99.
Kerosene and jet fuel do	2,457	2,627	400	Belgium-Luxembourg 1,462; United Kingdom 399.
Distillate fuel oil do	51,063	42,264	3,095	U.S.S.R. 26,249; Kuwait 4,389.
Lubricants do	2,318	2,257	134	United Kingdom 552; Belgium-Luxembourg 475; Italy 283.
Residual fuel oil do	32,189	13,800	NA	U.S.S.R. 5,413; Belgium-Luxembourg 2,221; Italy 283.
Bitumen and other residues do	668	800	NA	Belgium-Luxembourg 483; West Germany 309; France 2.
Bituminous mixtures do	122	565	2	West Germany 450; Belgium-Luxembourg 81; Italy 17.
Petroleum coke do	2,516	2,460	1,307	Norway 432; West Germany 376.

[r]Revised. NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—Kaiser Aluminum & Chemical Corp. sold its Kaiser Aluminium Europe (KAE) subsidiary to Hoogovens Group BV, retaining its 49% interest in the Anglesey Aluminium Smelter at Holyhead, Wales. The $354 million sale made Hoogovens one of the four largest rolled and extruded aluminum producers in Europe and increased the company's primary aluminum output by 77,000 tons per year. The acquisition included a smelter in Voerde; a sheet, plate, and extrusion plant in Koblenze; an extrusion plant in Vogt; and other plants in Belgium, the Federal Republic of Germany, and Switzerland. The Hoogovens smelter in Delfzijl, with a capacity of 170,000 tons per year, accounted for a significant portion of the total of 276,000 tons of primary aluminum produced in the Netherlands in 1987.

Iron and Steel.—Hoogovens Ijmuiden BV (HI) reported a loss of $84.7 million for 1987, compared with a profit of $75.9 million in 1986.[6] Sales revenues dropped to $2.9 billion (down 4%), and steel output was down 4.3%.[7] Other factors were closures for plant modernization and associated startup problems. Long-term investments were made totaling $542 million including the purchase of KAE and the 50% stake in the German steel producer Hille & Muller. Despite modernization investments by HI, the authorities planned to force the company to reduce sulfur dioxide emissions at the Ijmuiden works. To meet the environmental requirements, HI proposed to increase the output percentage of pellet feedstock. However, the company's pellet plant was operating at its capacity of 3.8 million tons per year. Furthermore, other European producers did not have the additional capacity to fulfill the increased demand for pellet consumption.[8]

Lead.—The Hollandse Metallurgische Industrie Billiton BV (HMI) plant in Arnhem, operating near capacity, produced 25,000 tons of lead in 1987, up slightly from its 1986 production. The country's production rose to 40,000 tons from 33,000 tons. HMI's increase was partly the result of improved efficiency of the plant's secondary refinery.

Magnesium.—About 91,000 tons of magnesia was produced by the deep solution method from mined salts in the northern portion of the Netherlands, by Noodelijke Zoutuinning NV and by Magnesia International NV, both owned by Billiton Refractories Inc.

Molybdenum.—Climax Molybdenum BV, a division of AMAX Inc., operated a 9,100-ton-per-year plant at Zozenburg. It produced molybdic oxides and other materials for the steel industry, by processing concentrates from mines in the United States.[9]

Zinc.—The Budelco BV zinc smelter

(owned 50% by Billiton's subsidiary Kempensche Zinkmaatschappij NV and 50% by Australian Mining and Smelting Ltd.) provided 104,000 of the 207,000 tons produced in the Netherlands in 1987. This modern and efficient electrolytic smelter was fed by zinc ore from 20 mines worldwide but chiefly from Canada. Budelco reported a financial crisis over environmental problems: It must dispose of large quantities of toxic waste including cadmium byproducts from smelting. The company also had high unpaid energy bills, and a weakened market had forced it to reduce the prices of its zinc.

INDUSTRIAL MINERALS

The abundant supply of local natural gas and the excellent harbor were the foundations upon which this Western European fertilizer industry was built. Initially, the port was used for importation of phosphate rock from North Africa; now Rotterdam shipped about 400,000 tons of fertilizer annually to the interior of the Continent and to other countries.

Several producers were modernizing plants for environmental or economic considerations. Nederlandse Stikstoft Maatschappij BV (NSM) replaced two ammonia-producing units built in the mid-1960's with a single unit with a record-high capacity of 1,750 tons per day and an operating efficiency of 22.54 million British thermal units per ton. The contractor, Santa Fe Braun Inc., completed it in 16.5 months compared with the normal time of 36 months. DSM Mestoffen BV was building a 1,400-ton-per-day replacement unit for its Gellen fertilizer complex. DSM Mestoffen also was ordered to close its phosphoric acid plant that was dumping cadmium-tainted waste into the Rhine.[10] The nation had other fertilizer pollution problems. The agricultural industry was consuming fertilizer at the rate of 0.62 ton per acre, an increase of 15% since the early 1980's and nearly twice the rate of fertilizer use in the Federal Republic of Germany.

MINERAL FUELS

The Government's historical dependence on hydrocarbon resources caused hardships in 1987. Declines in both price and volume of gas exports resulted in revenues of only $2.5 billion. The loss of income made Government deficit reduction much more difficult, but it also provided an opportunity to press for welfare reforms and for shifting the economy away from a dependence on gas income. But lower energy costs benefited both consumers and industrial users, because export prices could be reduced to maintain market share as the value of the guilder appreciated. Exploration and production companies, having cut staff and fixed expenses in 1986, ascertained they could profitably produce North Sea oil at the lower 1987 prices. Twenty-eight blocks were leased for exploration, and 35 exploration wells were proposed, 20% fewer than in 1986. Among the discoveries was a 178.6-billion-cubic-foot gasfield under Royal Dutch/Shell NV's Rotterdam refinery and the Nederlandse Aardolie Maatschappij BV's well in Block L/13, which tested at the rate of 28.6 million cubic feet per day. Also, Amoco Netherlands Petroleum Co.'s P/18-1 well tested 36 million cubic feet per day with 4,150 barrels per day of condensate as an offset to an earlier discovery in Block P/15.[11] Oil production from offshore fields was estimated at 90,000 barrels per day, down 8% from previous years. Reserves were estimated at 195 million barrels, and the seven refineries had a capability of 1.5 million barrels per day.

Planned for completion in 1988 were Shell's $350 million residue-hydro converter at Pernis and Atlantic Richfield Oil Co.'s octane-enhancer plant for gasoline at Botlek. Low natural gas prices caused the suspension of other projects, including one to pipe oil and gas from the northern part of the Netherlands continental shelf. The largest development project, the $1 billion F-3 project, was to access 429 billion cubic feet of gas and 37.7 million barrels of oil from several offshore fields. The Netherlands has ample gas supplies into the 21st century.

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[1]Physical scientist, Division of International Minerals.
[2]Where necessary, values have been converted from Netherlands guilder (f.) to U.S. dollars at the rate of f.2.03 = US$1.00, the average for 1987.
[3]Financial Times (London). The Netherlands. Nov. 23, 1987, Sec. 3, pp. 1-8.
[4]Work cited in footnote 3.
[5]Algemene Bank Nederland NV (Amsterdam). ABECOR Country Report. Dec. 1987.
[6]Metal Bulletin (London). Apr. 28, 1988, p. 23.
[7]Steel Times (London). Oct. 1987, p. 485.
[8]Metal Bulletin (London). Sept. 1987, p. 25.
[9]Mining Journal (London). May 22, 1987, p. 396; and Oct. 1987, p. 485.
[10]Phosphorus & Potassium (London). No. 148, Mar.-Apr. 1987, p. 12.
[11]Petroleum Economist (London). Feb. 1988, p. 62.

The Mineral Industry of New Zealand

By Travis Q. Lyday[1]

Most minerals occur in New Zealand, but few are found in economically commercial concentrations. The major exceptions continued to be coal, gold, natural gas, and titaniferous magnetite (iron) sands for the domestic and export markets; construction materials, primarily for domestic use. The extractive mineral industry of New Zealand contributed an estimated 1% to the gross national product (GNP), $27.9 billion[2] in fiscal year 1987 (ending March 31, 1987), for a 2.4% increase over the previous fiscal year. The mineral processing sector provided an estimated 4% to the GNP, based to a significant extent on imported alumina, fertilizer materials, and crude oil raw materials, raising the mineral industry total to about 5% of the GNP.

Government Policies and Programs.—The reforms the Government began in mid-1984, aimed at transforming the Nation's economy to one that was more market oriented, continued during 1987. The Ministry of Energy's State Coal Mines Division was reconstituted in April as a private corporation having more commercial objectives, i.e., market accountability. The Electricity Division of the Ministry of Energy was also reorganized into a private corporation in April. Now its activities are more commercial or free-market based.

At yearend, the Government proposed a petroleum sector reform bill that would abolish price controls on gasoline and remove regulations requiring ownership of gasoline service stations.

PRODUCTION AND TRADE

Reliable statistical information on production and trade was unavailable. Production levels have been estimated on the basis of the best available information.

The mineral industry in New Zealand consisted mainly of mining of coal; construction materials (clays, sand and gravel, and stone); limestone and marble for agricultural, chemical, and construction uses; and titaniferous magnetite sand (iron sands). Crude mineral production also included natural gas, natural gas liquids, and petroleum (condensate).

The mineral processing sector consisted chiefly of the production of primary aluminum, manufactured fertilizers, petroleum refinery products, and crude steel produced from imported raw materials.

Table 1.—New Zealand: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum metal, smelter:					
Primary	218,610	242,851	243,500	236,200	[2]248,900
Secondary	3,000	3,700	1,500	4,000	[2]4,000
Total	221,610	246,551	245,000	240,200	[2]252,900
Gold, mine output, Au content troy ounces	9,667	21,605	45,011	[e]46,000	45,000
Iron and steel:					
Iron ore, gross weight[3]	156	2,645	[e]2,000	[e]2,000	2,000
Iron sand (titaniferous magnetite):					
Gross weight thousand tons	2,203	2,414	2,520	2,580	[2]2,290
Fe content do	1,256	1,376	[e]1,425	[e]1,425	1,300
Pig iron (sponge iron)[e] do	155	170	170	200	200
Steel, crude do	233	274	228	[e]287	300
Lead, refinery output, secondary[e]	6,000	6,000	6,000	4,000	[2]3,600
Silver, mine output, Ag content troy ounces	31	--	--	--	--
Tungsten, mine output (scheelite):					
Gross weight	11	13	[e]10	[e]10	10
W content	6	6	[e]5	[e]5	5
INDUSTRIAL MINERALS					
Cement, hydraulic thousand tons	760	823	863	906	[2]902
Clays:					
Bentonite	1,958	6,418	[e]6,000	[e]6,000	6,000
Kaolin (pottery)	23,917	25,098	[e]25,000	[e]25,000	25,000
For brick and tile	97,944	146,840	[e]145,000	[e]145,000	145,000
Lime[e]	165,000	150,000	160,000	160,000	160,000
Nitrogen: N content of ammonia	43,200	58,000	74,000	[e]60,000	60,000
Perlite	1,008	--	--	--	--
Pumice	16,799	15,182	[e]20,000	[e]20,000	20,000
Salt	81,000	57,000	[e]60,000	[e]60,000	60,000
Sand and gravel:					
Silica sand (glass sand)	148,357	133,235	[e]50,000	[e]50,000	50,000
Other industrial sand	234,403	387,209	[e]350,000	[e]350,000	350,000
For roads and ballast thousand tons	15,489	16,501	[e]15,000	[e]15,000	15,000
For building aggregate do	4,359	5,029	[e]5,000	[e]5,000	5,000
Stone:					
Dolomite	17,033	18,124	[e]18,000	[e]18,000	18,000
Greenstone kilograms	435	3,052	[e]3,000	[e]3,000	3,000
Limestone and marl:					
For agriculture thousand tons	1,460	1,524	[e]1,500	[e]1,500	1,500
For cement do	1,497	1,621	[e]1,500	[e]1,500	1,500
For other industrial uses do	207	214	[e]215	[e]215	215
For roads do	274	359	[e]350	[e]350	350
Serpentine	64,055	76,900	[e]75,000	[e]75,000	75,000
Unspecified:					
Dimension	22,585	36,359	[e]35,000	[e]35,000	35,000
Rock for harbor work thousand tons	2,254	2,520	[e]2,500	[e]2,500	2,500
Sulfur	1,090	862	[e]1,000	[e]1,000	1,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon dioxide, liquefied[e]	10,000	10,000	10,000	10,000	10,000
Coal:					
Anthracite thousand tons	2	--	[e](4)	[e](4)	(4)
Bituminous do	496	582	[e]609	[e]600	[e]600
Subbituminous do	1,752	1,709	[e]1,573	[e]1,400	1,500
Lignite do	235	235	[e]227	[e]200	200
Total do	2,485	2,526	[e]2,409	[e]2,200	2,300
Coke:					
Coke oven	2,060	[e]2,100	[e]2,000	[e]2,000	2,000
Gashouse	6,129	[e]6,200	[e]6,000	[e]6,000	6,000
Total	8,189	[e]8,300	[e]8,000	[e]8,000	8,000
Fuel briquets	4,453	[e]4,500	[e]5,000	[e]5,000	5,000
Gas:					
Manufactured (from gasworks)[e] million cubic feet	845	609	517	356	350
Natural:					
Gross production[e] do	105,000	127,200	157,700	188,900	190,000
Marketed production do	91,465	110,817	137,162	164,283	165,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS — Continued					
Natural gas liquids:[e]					
Liquefied petroleum gas _ thousand 42-gallon barrels_ _	532	483	910	976	1,000
Natural gasoline _____ do_____	94	85	160	172	175
Total _____ do_____	626	568	1,070	[2]1,148	1,175
Petroleum:					
Crude _____ do_____	5,268	6,635	8,065	11,833	12,000
Refinery products:					
Gasoline _____ do_____	10,668	10,965	6,001	13,150	13,500
Distillate fuel oil _____ do_____	4,551	4,588	2,462	4,588	5,000
Residual fuel oil _____ do_____	2,331	2,311	1,998	1,512	1,500
Other _____ do_____	784	931	637	679	750
Refinery fuel and losses _____ do_____	805	798	525	784	800
Total _____ do_____	19,139	19,593	11,623	20,713	21,550

[e]Estimated. [p]Preliminary.
[1]Table includes data available through June 15, 1988.
[2]Reported figure.
[3]Not used for manufacture of iron; reportedly consumed for gas purification, preparation of stock licks, and manufacture of brick. Because of these uses, iron content is not reported.
[4]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides value, thousands_ _	_ _	$4	_ _	All to Australia.
Metal including alloys:				
Scrap _____	3,210	4,594	_ _	Japan 3,941; Australia 170.
Unwrought _____	235,570	199,963	_ _	Japan 163,765; China 16,134; Republic of Korea 11,935.
Semimanufactures _____	9,066	7,079	151	Australia 3,898; Indonesia 1,113; Singapore 264.
Copper: Metal including alloys:				
Scrap _____	1,213	653	_ _	Australia 240; India 132; Hong Kong 70.
Unwrought ___ value, thousands_ _	$57	$4	$1	Fiji $3.
Semimanufactures _____ do_____	$7,166	$10,188	$1,865	Australia $6,459; Singapore $376.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite _ _ thousand tons_ _	2,091	2,217	_ _	Mainly to Japan.
Metal:				
Scrap _____	([3])	3,315	_ _	Japan 2,444; Australia 388.
Pig iron, cast iron, related materials_ _ _____	_ _	4	4	
Ferroalloys _____	_ _	2	_ _	Mainly to Australia.
Steel, primary forms _____	37,443	102,957	_ _	China 54,669; Singapore 45,700; Fiji 2,419.
Semimanufactures:				
Bars, rods, angles, shapes, sections _____	40,363	46,283	7,152	China 27,440; Australia 3,097.
Universals, plates, sheets _ _	46,109	49,849	20,821	Australia 14,331; Pakistan 2,266; Fiji 2,236.
Hoop and strip _____	79	112	36	Australia 36.
Rails and accessories _____	5	6	_ _	All to Papua New Guinea.
Wire _____	11,645	3,277	759	Hong Kong 1,307; Australia 662.
Tubes, pipes, fittings _____	3,492	4,476	406	Papua New Guinea 1,317; Australia 703; Singapore 634.
Castings and forgings, rough	154	121	21	Australia 64; Singapore 11.
Lead: Metal including alloys:				
Scrap _____	171	161	_ _	Australia 106; Hong Kong 17.
Unwrought and semimanufactures _ _	64	118	_ _	Australia 101.
Magnesium: Metal including alloys, all forms _____	1	([3])	_ _	All to Thailand.
Mercury _____ value, thousands_ _	$1	$1	_ _	All to Fiji.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Molybdenum: Metal including alloys, all forms value, thousands	--	$2	--	Mainly to Australia.
Nickel: Metal including alloys:				
Scrap	1	42	--	Japan 39.
Semimanufactures	(4)	31	--	All to Australia.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$1	$28	--	United Kingdom $18; Australia $10.
Silver:				
Waste and sweepings do	$825	$147	--	United Kingdom $85; Australia $61.
Metal including alloys, unwrought and partly wrought do	$753	$855	--	Australia $850.
Tin: Metal including alloys:				
Scrap	88	103	--	United Kingdom 84; West Germany 19.
Semimanufactures	218	178	--	French Polynesia 120; Australia 43.
Titanium: Oxides value, thousands	--	$6	$1	Australia $3.
Tungsten: Metal including alloys, all forms do	--	$57	--	Australia $54.
Zinc: Metal including alloys, all forms	380	1,102	--	Australia 236; unspecified 828.
Other:				
Ores and concentrates	--	26	--	All to Australia.
Oxides and hydroxides	3	--		
Ashes and residues	2,083	2,638	--	Japan 759; Australia 525.
Base metals including alloys, all forms value, thousands	$59	$5	$4	Australia $1.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	87	154	--	Australia 129.
Grinding and polishing wheels and stones value, thousands	$77	$183	$16	Australia $60; Fiji $35; India $18.
Asbestos, crude do	--	$2	--	All to Papua New Guinea.
Barite and witherite	10	1,345	--	Indonesia 1,194; Singapore 150.
Boron materials: Oxides and acids	--	1	--	All to Fiji.
Cement	184,780	91,386	--	French Polynesia 38,550; Papua New Guinea 20,851; Tonga 6,265.
Chalk	1	4	--	Norfolk Island 2; Fiji 1.
Clays, crude	14,903	15,423	--	Japan 8,327; Republic fo Korea 2,118; United Kingdom 525.
Diamond:				
Gem, not set or strung value, thousands	$230	$861	$20	Australia $747.
Industrial stones do	--	$60	--	All to United Kingdom.
Diatomite and other infusorial earth do	--	$3	--	All to Fiji.
Fertilizer materials:				
Crude, n.e.s	537	116	--	Singapore 50; Malaysia 34; Australia 28.
Manufactured:				
Ammonia	6	7	--	Cook Islands 3; Tonga 3.
Nitrogenous	53,189	69,725	64,733	Japan 4,025; Papua New Guinea 309.
Phosphatic	272	226	--	Fiji 152; Cook Islands 40.
Potassic value, thousands	$22	$24	--	Fiji $15; Papua New Guinea $4.
Unspecified and mixed	1,217	1,145	19	Cook Islands 439; Fiji 195; Samoa 174.
Gypsum and plaster	430	156	--	Indonesia 61; Papua New Guinea 29; Bahrain 21.
Lime	782	1,963	--	Fiji 1,081; French Polynesia 458; Australia 233.
Mica: Crude including splittings and waste	--	12	--	Singapore 10.
Phosphates, crude	15	8	--	All to Singapore.
Pigments, mineral: Iron oxides and hydroxides, processed	(5)	6	--	Fiji 4.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$182	$426	$151	Australia $168; Hong Kong $57.
Synthetic do	$5	$6	--	West Germany $4; Australia $3.
Salt and brine	2,610	3,123	--	Australia 1,742; American Samoa 401; Fiji 332.
Sodium compounds, n.e.s.: Carbonate, manufactured	(6)	57	--	All to Fiji.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked value, thousands	$43	$5	--	Fiji $4.
Worked do	$73	$69	--	Samoa $32; Cook Islands $14.
Dolomite, chiefly refractory-grade do	$4	$6	--	All to Australia.
Gravel and crushed rock	990	454	49	Malaysia 378.
Limestone other than dimension	279	301	--	New Caledonia 300.
Sand other than metal-bearing	327	256	--	Australia 227.
Sulfur: Sulfuric acid	217	218	--	Fiji 105; Papua New Guinea 74.
Talc, steatite, soapstone, pyrophyllite	207	2	--	All to Australia.
Other:				
Crude	562	610	--	Fiji 266; Australia 217; French Polynesia 81.
Slag and dross, not metal-bearing	187	119	--	India 77; Hong Kong 18.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	3	46	--	Samoa 36; Niue 10.
Coal: Anthracite and bituminous	415,762	281,650	--	Japan 265,409; Republic of Korea 16,241.
Coke and semicoke value, thousands	--	$10	--	All to Australia.
Peat including briquets and litter	(7)	4,231	--	Australia 3,972.
Petroleum:				
Crude thousand 42-gallon barrels	2,557	1,810	--	Australia 996; Singapore 814.
Refinery products:				
Liquefied petroleum gas value, thousands	$240	$125	--	Australia $107.
Gasoline 42-gallon barrels	230	435,582	17	Australia 341,343; Singapore 93,959.
Mineral jelly and wax do	275	71	--	Fiji 31.
Kerosene and jet fuel do	1,163	2,829	--	Fiji 1,232; Vanuatu 450; Papua New Guinea 372.
Distillate fuel oil do	545	425	--	Cook Islands 276; Vanuatu 104.
Lubricants value, thousands	$1,321	$1,405	$17	Fiji $590; Australia $309; Cook Islands $130.
Residual fuel oil 42-gallon barrels	226,500	7	--	Mainly to Fiji.
Bitumen and other residues do	85	291	--	All to Solomon Islands.
Bituminous mixtures do	5,357	5,236	--	Fiji 1,285; Norfolk Island 945; Tonga 745.

[1]Table prepared by Audrey D. Wilkes.
[2]Unreported quantity valued at $1,378,000.
[3]Unreported quantity valued at $1,000.
[4]Unreported quantity valued at $6,000.
[5]Less than 1/2 unit.
[6]Unreported quantity valued at $55,000.
[7]Unreported quantity valued at $527,000.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and rare-earth metals value, thousands	$36	$17	$1	China $6; United Kingdom $6.
Aluminum:				
Ore and concentrate	5	1,550	--	All from Guyana.
Oxides and hydroxides	503,072	445,789	20	Australia 442,215; Japan 2,336.
Metal including alloys:				
Scrap	50	42	--	Fiji 10; unspecified 30.
Unwrought	749	288	1	United Kingdom 163; Australia 54.
Semimanufactures	4,895	6,505	58	Australia 4,815; Japan 515.
Beryllium: Metal including alloys, all forms value, thousands	--	$1	--	Mainly from West Germany.
Chromium:				
Ore and concentrate	161	18	--	All from Republic of South Africa.
Oxides and hydroxides	514	163	94	West Germany 52.
Cobalt: Oxides and hydroxides	23	5	1	Finland 2.
Copper:				
Matte and speiss including cement copper	--	1	--	All from United Kingdom.
Metal including alloys:				
Scrap	(2)	--		
Unwrought	2,176	1,487	3	West Germany 762; Australia 380; Oman 314.
Semimanufactures[3]	17,272	16,989	46	Australia 7,415; Japan 690.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	301	41	--	All from Australia.
Pyrite, roasted	14	--		
Metal:				
Scrap	2,839	5,508	--	Australia 2,464; New Caledonia 1,416; French Polynesia 1,141.
Pig iron, cast iron, related materials	1,652	929	1	Australia 534; United Kingdom 210; Malaysia 100.
Ferroalloys:				
Ferromanganese	409	923	--	Australia 684; Japan 209.
Unspecified	3,578	2,754	40	Australia 2,571.
Steel, primary forms	1,835	38	NA	United Kingdom 24; Australia 11.
Semimanufactures:				
Bars, rods, angles, shapes, sections	108,591	73,703	107	Australia 39,452; Japan 22,496; United Kingdom 7,141.
Universals, plates, sheets	352,980	347,548	1,047	Japan 264,971; Australia 63,735; United Kingdom 10,884.
Hoop and strip	18,219	16,599	101	Australia 8,692; Japan 5,847.
Rails and accessories	10,047	6,821	1	United Kingdom 6,072; Australia 361.
Wire	20,095	14,512	37	Australia 4,778; Republic of Korea 3,199; United Kingdom 2,509.
Tubes, pipes, fittings	35,173	24,317	298	Australia 9,525; Japan 9,362; Republic of Korea 2,059.
Castings and forgings, rough	107	68	1	United Kingdom 50; Australia 13.
Lead:				
Oxides	109	105	1	United Kingdom 57; Australia 38; China 10.
Metal including alloys:				
Scrap	18	123	--	Australia 105.
Unwrought	5,002	3,699	1	Australia 3,694.
Semimanufactures	158	123	NA	Australia 120.
Magnesium: Metal including alloys:				
Unwrought value, thousands	$763	$796	$102	Norway $658.
Semimanufactures do	$58	$79	$1	Canada $64.
Manganese:				
Ore and concentrate	58	27	NA	Singapore 17; Republic of South Africa 6.
Oxides	966	712	34	Japan 460; Australia 192.
Mercury value, thousands	$16	$11	--	Netherlands $5; Australia $3.
Molybdenum: Metal including alloys, all forms do	$131	$95	$7	United Kingdom $37; Austria $25; Australia $16.
Nickel:				
Matte and speiss	--	1	--	All from Norway.
Metal including alloys:				
Unwrought	95	19	--	West Germany 18.
Semimanufactures	168	169	103	West Germany 31; Australia 25.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$715	$308	--	United Kingdom $212; Switzerland $41.
Silver:				
Waste and sweepings[4] do	$37	$100	--	Australia $94.
Metal including alloys, unwrought and partly wrought do	$1,758	$1,391	$42	Australia $1,215.
Tin: Metal including alloys, all forms	175	194	4	Malaysia 123; Australia 66.
Titanium: Oxides	1,536	1,274	32	Finland 503; Australia 500; Japan 140.
Tungsten: Metal including alloys, all forms value, thousands	$467	$448	$22	United Kingdom $289; Netherlands $100.
Zinc:				
Oxides	313	362	1	Australia 264; Republic of South Africa 52.
Metal including alloys:				
Unwrought	20,889	17,871	NA	Australia 11,997; Canada 5,869.
Semimanufactures[5]	59	42	NA	Australia 18; West Germany 12.
Other:				
Ores and concentrates	1,141	612	--	Australia 246; China 200; Japan 109.
Ashes and residues	14	11	--	All from Australia.
Base metals including alloys, all forms value, thousands	$516	$376	$40	United Kingdom $124; China $86; Australia $78.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	393	240	106	Australia 37; Italy 36; West Germany 21.
Artificial: Corundum	212	278	33	Australia 225.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$222	$197	$137	United Kingdom $35; Australia $14.
Grinding and polishing wheels and stones do	$2,528	$2,063	$292	Japan $347; Australia $332; United Kingdom $307.
Asbestos, crude	1,355	896	--	Canada 738; Zimbabwe 144.
Barite and witherite	5,202	2,833	51	Singapore 953; Australia 868; Thailand 764.
Boron materials:				
Crude natural borates value, thousands	$530	$170	$38	Netherlands $81; Argentina $50.
Oxides and acids	1,364	1,795	1,575	Italy 198.
Cement	3,934	2,727	43	Australia 810; Singapore 387; Malaysia 336.
Chalk	842	769	1	United Kingdom 645; Australia 101.
Clays, crude	13,944	13,277	2,474	Australia 8,824; United Kingdom 1,200.
Cryolite and chiolite	224	59	--	All from Denmark.
Diamond:				
Gem, not set or strung value, thousands	$3,045	$5,383	$260	India $2,807; Israel $762; Belgium-Luxembourg $543.
Industrial stones do	$303	$356	$10	Australia $319.
Diatomite and other infusorial earth	1,161	1,612	1,255	Australia 264; United Kingdom 53.
Feldspar, fluorspar, related materials	1,049	684	--	Canada 321; Norway 164; China 70.
Fertilizer materials:				
Crude, n.e.s	--	10,325	10,310	United Kingdom 15.
Manufactured:				
Ammonia	12	44	1	Australia 39.
Nitrogenous value, thousands	$8,592	$6,554	$1,301	Japan $2,188; West Germany $1,041; Australia $769.
Phosphatic	43,310	39,340	39,338	West Germany 1.
Potassic	165,160	71,715	30,179	Canada 23,333; U.S.S.R. 17,539.
Unspecified and mixed value, thousands	$11,304	$3,801	$1,814	West Germany $1,391; Netherlands $339.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Graphite, natural	77	143	17	Sri Lanka 78; United Kingdom 26.
Gypsum and plaster	129,720	171,862	14,866	Australia 118,144; Thailand 38,600.
Lime	21	5	5	
Magnesium compounds: Magnesite, crude including sintered	7,618	4,276	26	China 3,871; Australia 191.
Mica:				
Crude including splittings and waste value, thousands	$147	$162	$10	China $42; Republic of South Africa $29; India $21.
Worked including agglomerated splittings do	$243	$181	$35	Australia $55; United Kingdom $46.
Nitrates, crude	75	40	--	All from Chile.
Phosphates, crude	821,855	278,132	32,500	Nauru 157,433; Christmas Island 88,198.
Pigments, mineral: Iron oxides and hydroxides, processed	1,947	1,610	31	West Germany 1,390.
Potassium salts, crude	--	96	--	Australia 78; United Kingdom 18.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$1,840	$2,457	$20	Thailand $1,036; Australia $534; Hong Kong $409.
Synthetic do	$201	$106	$36	West Germany $25; Republic of Korea $19.
Pyrite, unroasted	1	23	--	All from Australia.
Salt and brine	64,184	88,221	1	Bahamas 33,132; Australia 28,366; Netherlands Antilles 26,600.
Sodium compounds, n.e.s.: Carbonate, manufactured	31,537	35,866	32,230	Australia 3,376.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	5,053	2,896	--	Republic of South Africa 1,101; Italy 816; Spain 274.
Worked value, thousands	$1,056	$2,686	$7	Italy $574; Australia $561; China $336.
Dolomite, chiefly refractory-grade	17	14	--	West Germany 13.
Gravel and crushed rock	295	100	--	Australia 54; United Kingdom 26; France 20.
Quartz and quartzite	205	170	17	Australia 84; West Germany 21.
Sand other than metal-bearing	448	409	23	Australia 268; Japan 104.
Sulfur:				
Elemental:				
Crude including native and by-product	234,677	95,964	5,150	Canada 87,787; Nauru 3,025.
Colloidal, precipitated, sublimed	523	843	17	Australia 794.
Sulfuric acid	32	29	1	United Kingdom 25.
Talc, steatite, soapstone, pyrophyllite	2,609	1,931	12	Australia 1,000; China 778; Republic of Korea 108.
Other:				
Crude value, thousands	$867	$417	$18	Austria $211; Republic of South Africa $68; Kenya $28.
Slag and dross, not metal-bearing	207	746	--	Australia 444; West Germany 293.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1	115	25	Trinidad and Tobago 90.
Carbon black	6,686	6,175	105	Australia 5,815.
Coal:				
Anthracite and bituminous	547	339	229	Australia 108.
Briquets of anthracite and bituminous coal	--	292	--	Australia 291.
Lignite including briquets	--	8	8	
Coke and semicoke value, thousands	$351	$262	--	All from Australia.
Petroleum:				
Crude thousand 42-gallon barrels	6,143	8,472	--	Indonesia 4,337; Saudi Arabia 3,941.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products:				
Liquefied petroleum gas value, thousands	$76	$421	$25	Australia $335.
Gasoline ---do---	$212,015	$110,371	$12,181	Singapore $26,252; Australia $23,856; Saudi Arabia $11,081.
Mineral jelly and wax ---do---	$2,928	$2,623	$340	China $751; Australia $469.
Kerosene and jet fuel ---do---	$95,042	$85,226	$634	Singapore $56,776; Australia $20,035; Republic of Korea $3,940.
Distillate fuel oil ---do---	$164,290	$96,732	$19,816	Australia $28,401; Singapore $22,065; Bahrain $10,263.
Lubricants ---do---	$32,067	$22,617	$3,058	Australia $10,425; Singapore $6,294.
Residual fuel oil ---do---	$31,902	$14,776	--	Saudi Arabia $13,676.
Bitumen and other residues 42-gallon barrels	194,865	1,157	97	Australia 721.
Bituminous mixtures ---do---	3,430	90,761	--	Spain 90,536.
Petroleum coke ---do---	533,550	588,230	582,400	Australia 5,709.

NA Not available.
[1]Table prepared by Audrey D. Wilkes.
[2]Less than 1/2 unit.
[3]Excludes unreported quantities valued at $3,751,000 in 1985 and $3,055,000 in 1986.
[4]May include other precious metals.
[5]Excludes unreported quantities valued at $681,000 in 1985 and $561,000 in 1986.

COMMODITY REVIEW

METALS

Gold and Silver.—Waihi Gold Mining Co. Ltd., a joint venture of Australian Consolidated Minerals Ltd. (28.35%), Amax Gold Inc. (28.35%), Mineral Resources NZ Ltd. (27.84%), and Goodman Fielder NZ Ltd. (15.46%), began construction of a 600,000-ton-per-year mining and processing facility at the Martha Hill gold mine, following the granting of a mining lease and the signing of financing agreements. The mine is 110 kilometers southeast of Auckland, on the Coromandel Peninsula, North Island. The plant will recover 50,000 troy ounces of gold and 300,000 troy ounces of silver per year.

R. A. Hanson Co. Inc. and Giant Resources Ltd. announced that they will hold equal shares in Grey River Gold Mining Ltd. The company will recover gold from the extensive alluvial reserves in the Grey River, near Greymouth, South Island. Gold production is scheduled to begin during the second quarter of 1989.

Iron Ore and Iron Sands.—For the fiscal year ending March 1988, Japanese steel mills agreed to buy 460,000 tons from Waipipi Iron Sands Ltd.'s placer mining operations at Waverly, along the southeastern coast of North Island. The mills indicated that the contract would not be renewed in 1988. This was announced after rumors circulated that the mine would close. Waipipi Iron Sands is owned by Utah International Inc. and Viking Mining Co.

Platinum.—Platinum Group Metals NL (PGM), a newly formed stock company in which the Australian firm United and Commercial Holdings Ltd. took a 15.2% interest, outlined its platinum prospects on South Island in a prospectus issued in January. The company continued exploration and reserve estimation on its alluvial properties, which reportedly contain economic grades of gold and platinum. Production from these alluvial deposits would probably be toll refined at Johnson Matthey Ltd.'s precious metals refinery in Auckland, North Island.

Steel.—Near yearend, New Zealand Steel Ltd. brought on-stream the cold-rolling mill at its Glenbrook works. Commercial production was to begin in February 1988, when the hot-strip mill came on-stream. When New Zealand Steel's expansion is completed, capacity will be 750,000 tons per year.

In midyear, New Zealand Steel was put up for sale, but the offers were rejected because the offerings did not give an adequate return on the investment made by the

Government. The Government acquired 90% of the company when it assumed the steelmaker's debts. New Zealand Steel obtained Government help following costly overruns in its expansion program. The Government always made it clear that it intended to dispose of its shares when the company was more sound financially.

In April, the Government announced plans to phase out import licensing for most iron and steel products effective January 1, 1988. Duties currently in place, ranging from 10% to 25%, would be retained.

MINERAL FUELS

Coal.—The State Coal Mines Division of the Ministry of Energy was reconstituted on April 1 as a state-owned enterprise, the Coal Corp. of New Zealand Ltd. (Coalcorp), with commercial objectives. The division's assets were transferred to Coalcorp by yearend 1987 after debts were restructured and the assets were valued. In setting up Coalcorp, the Government faced difficult problems because the former State Coal Mines Division had accumulated considerable financial losses for a variety of reasons, including low coal prices, mining difficulties, and environmental restrictions. As a result of commercialization, the work force was halved from about 1,600 workers in the old division to 800 workers for Coalcorp. Government regulatory privileges and constraints will be removed to ensure that Coalcorp competes on the same basis as the private coal producers. The State Coal Mines Division produced about 70% of the country's coal from more than a dozen mines.

Natural Gas and Petroleum.—New Zealand Synthetic Fuels Corp. Ltd., owned by the Government (75%) and Mobil New Zealand Ltd. (25%), operated the world's first large-scale plant to produce synthetic gasoline at Motunui on North Island's west side. The plant operated at about its capacity of 14,500 barrels per day of gasoline, converting natural gas from the Maui offshore gasfield (about one-third of its production) to methanol, then to gasoline. The plant operated on a tolling basis; the gasoline produced was owned by the Crown, represented by the Ministry of Energy, which then sold it to the oil companies for blending at the Marsden Point refinery or for export.

The Maui Gasfield continued to be the principal source of gas supply in New Zealand, representing about 90% of production. A reassessment of the gas reserves in the field were reportedly completed by yearend, but the results were unknown. Maui supplied the synthetic gasoline plant at Motunui with compressed natural gas for automotive fuel, for electricity generation, and for the country's two petrochemical plants that produced methanol and ammonia urea for export.

The Government heavily regulated New Zealand's only oil refinery at Marsden Point near Whangarei, North Island. It was operated by New Zealand Refining Co. Ltd., a consortium of Shell Oil New Zealand Ltd.; BP Oil New Zealand Ltd.; Europa Oil (NZ) Ltd., a subsidiary of BP Oil; Mobil Oil New Zealand Ltd.; Caltex Oil (NZ) Ltd.; and the Government. The plant was expanded to about 70,000 barrels per day crude throughput capacity in 1986, providing the capability of using a wider variety of feedstock, e.g., heavier types of crude oil, and the ability to produce a more diverse range of products, e.g., aviation gasoline. The Government continued to require the licensed oil companies to use the Marsden Point refinery to the maximum extent possible in meeting their supply requirements. A licensing system restricted the number of gasoline wholesalers and retailers.

However, near yearend 1987, the Government proposed a petroleum sector reform bill that would abolish all controls over pricing and distribution of gasoline in the country. The existence of the Marsden Point refinery could be threatened if such legislation were passed. The monopoly held by the refinery on refined petroleum would disappear when controls on imports of refinery products were lifted. The Government indicated, however, that tariff assistance might be offered to protect the refinery, but this was not part of the proposed reform bill.

In a yearend 1985 revision of its role in petroleum exploration and development, the Government decided not to invest in any new license areas. During 1987, the Government sold its 51% share in the Petroleum Mining License for the small McKee and Kaimiro onshore oilfield to Petroleum Corp. of New Zealand (Petrocorp), the state-owned oil and gas company, which was partially privatized (31%) in early 1987. The sale gave Petrocorp 100% ownership. The Government also offered for sale, on a trial basis, its 11% noncontributory interest in three petroleum Prospecting License Areas.

New Zealand was about 50% self-sufficient in liquid fuels, with about 20% from condensate from the onshore Kapuni and the offshore Maui gasfields, 14% from the synthetic gasoline plant, 5% from the use of liquefied petroleum gas and compressed natural gas in vehicles, and 11% from indigenous oil supplies.

NONMINERAL ENERGY RESOURCES

In keeping with overall economic policies, the Government decided to open the country's electricity market to competition from other potential producers. Production and transmission of bulk electricity has been a State monopoly since the 1920's, with distribution carried out by 61 local supply authorities. The Electricity Corp. of New Zealand Ltd. (Electricorp) was established and given clear commercial goals on April 1. It was told to enter into direct supply arrangements with large industrial consumers, bypassing the local supply authorities. With the establishment of Electricorp, it was intended that there would be no more direct Government control of wholesale electricity prices. Electricorp generated and sold electricity from a combination of hydroelectric, geothermal, coal, and natural gas power stations.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from New Zealand dollars (NZ$) to U.S. dollars at the rate of NZ$1.00=US$0.63.

The Mineral Industry of Nigeria

By Michael D. Fenton[1]

The petroleum sector continued to dominate the Nigerian economy with crude oil exports accounting for about 95% of the country's export revenues and 70% of the Government's budgetary resources. Nigeria's proven reserves of oil were over 16 billion barrels, and short-term productive capacity was about 1.8 million barrels per day (bbl/d). Nigeria was ninth in the world with about 84 trillion cubic feet of natural gas reserves, 70% of which were onshore, and all were in the Niger Delta area. Some associated gas was used industrially, but large nonassociated gasfields were unexploited. The Nigerian National Petroleum Corp. (NNPC) marketed 70% of total oil production in the country, and its activities accounted for 20% of Nigeria's gross domestic product.

The Government announced that it planned to phase out petroleum subsidies beginning March 1988, which cost the Government about $1.6 billion per year. Crude oil was sold in Nigeria for about $2.70 per barrel while the international price was about $18. Petroleum product prices in Nigeria were six to eight times below the prices prevailing in neighboring African countries, and cancellation of subsidies would tend to decrease the estimated 30,000 to 50,000 bbl/d of gasoline smuggled out of Nigeria.

The mining sector of the economy appeared to be in a state of deep crisis during 1987.[2] Mining revenue declined owing to inadequate supplies of spare parts for maintenance, deterioration of physical plants, reduced demand from domestic consumers, and the usual problems associated with underdevelopment: inexperienced management, unskilled labor, inadequate financing, and bureaucracy. Nevertheless, the Nigerian Mining Corp. (NMC) announced that it planned to increase exploration for lead, rock salt, uranium, and zinc.

PRODUCTION AND TRADE

As a member of the Organization of Petroleum Exporting Countries (OPEC) and its sixth-largest producer, Nigeria began the year with a new OPEC oil production quota of 1.238 million bbl/d, and it announced that it would phase out all netback agreements by February 1 in favor of an official fixed price of $18.92 for Bonny Light crude oil. This action was consistent with OPEC's new policy of maintaining oil at or above $18 per barrel, and it closely followed a similar netback cancellation by Saudi Arabia. Under a netback arrangement, the price of crude oil was based on the prevailing value of oil products, including gasoline and heating oil, on the open market. Problems developed immediately for the oil-producing companies within Nigeria and the Nigerian Government when Nigerian Bonny Light began trading on the European spot market at a premium of as much as $0.18 above competing North Sea Brent crude, which had fallen below $18 per barrel, well below Nigeria's $18.92 official selling price. Also, as an indication of resistance by markets to fixed prices, Nigeria's oil production fell from 1.28 million bbl/d to 1.05 million bbl/d in January. The new pricing policy was of considerable concern to oil-producing companies within Nigeria

because they were obligated to lift the NNPC's share of production. Falling world prices for oil were expected to erode a previously agreed-upon $2 per barrel profit margin if they found themselves committed to lift unattractively priced NNPC oil in addition to their equity crude. Negotiations over the complex issues of prices, profit margins, and taxes were continuing through July at which time the OPEC quota was raised to 1.301 million bbl/d and production rose to that level.

Production of oil declined by about 9% below that of 1986 to an annual average of 1.33 million bbl/d, which conformed to Nigeria's OPEC quota of 1.301 million bbl/d plus additional production deemed to be condensate. Production of associated gas was 660 billion cubic feet, of which 473 billion cubic feet was flared. The only significant exploitation of gas was as feedstock in the nitrogenous fertilizer plant operated by National Fertilizer Co. of Nigeria at Onne, near Port Harcourt in Rivers State. Nigeria earned about $6.5 billion from oil exports in 1987, about the same as in 1986. In contrast, 1980 earnings were about $25 billion.

Three operating petroleum refineries had a combined design capacity of 260,000 bbl/d, but technical constraints restricted throughput, and refined products were imported to meet domestic demand of about 265,000 bbl/d. NNPC exported oil for offshore processing and brought back products, particularly gasoline and kerosene, to make up shortfalls. Residual fuel oil in excess of domestic demand was exported to the U.S. east coast.

NNPC's refineries had a combined design capacity of nearly 2.2 million barrels per year of liquefied petroleum gas (LPG), but actual production never exceeded 1.16 million barrels. Production during 1987 was estimated by NNPC at only 837,000 barrels, and Nigeria imported nearly 700,000 barrels of LPG during the year. The Government was trying to encourage domestic consumption of LPG in rural areas to replace kerosene and firewood, but the high cost of LPG cooking equipment was a problem to be resolved.

The Government announced that Nigeria had been allocated a production quota of about 1,500 tons of tin by the Association of Tin Producing Countries (ATPC). Production of tin concentrates and metal increased in 1987. Over 500 tons was exported to Europe, and the remainder was sold locally in the form of tin with its alloys of lead and antimony. Makeri smelted less than its annual allocation from ATPC, a result of low world tin prices. Exploration for lode and alluvial tin included geological mapping, trenching, and sampling in the Darkuma and Iregun areas.

Coal mining, one of the oldest industries in Nigeria, was producing far below its potential. Problems in the industry included poor finance, unsteady power supply, lack of equipment, and obsolete infrastructure. In early 1987, the Government reversed itself by pledging the development of the coal industry to satisfy foreign demand and to earn needed export revenue. Italy took 30,000 tons of coal in 1986, and the Government claimed that inquiries had been made from other markets about the availability of as much as 5 million tons of Nigerian coal per year. Barter trade deals had been suggested that would trade coal for modern mining equipment. The Government also expected that domestic demand would increase as several planned coal-fired powerplants are built. The Nigerian Coal Corp.'s (NCC) new development program covered expansion of the Enugu underground mines in Anambra State, as well as the Okaba and Owukpa open pit mines and development of a new mine at Ogbouoga in Benue State. The goal was to increase annual production to 3 million tons by 1990, of which about two-thirds would be for export, and about 300,000 tons would be for the Ajaokuta steel plants for blending with imported coking coal. The source of funds for this ambitious program was not stated.

The NCC produced 110,170 tons of coal from four mines during 1987. The Okpara and Onyeama underground mines produced 31,256 tons and 33,358 tons, respectively. The open pit Owukpa and Okala mines produced 18,567 tons and 26,989 tons, respectively. NCC was doing geological and geophysical investigations of coal deposits west of the Enugu coalfield to update the coal reserve and to determine future mining methods. All production was needed domestically; therefore, none was exported.

The Delta Steel Co. (Aladja) steel production plant at Aladja and the three rolling mills at Jos, Oshogbo, and Katsina were operating at less than one-third of capacity over the past 2 years. They depended on imports of iron ore from Brazil and Liberia and steel billets from Western Europe. Aladja's production since its beginning 4 years ago was 630,000 tons of steel billets. Its 1987 production was slightly more than that of 1986, but was less than one-half of planned

production. The quantities of materials produced were as follows: rolled products, 53,762 tons; billets, 130,381 tons; liquid steel, 136,552 tons; direct-reduction iron, 130,772 tons; oxide pellets, 165,915 tons; burnt lime, 13,398 tons; and foundry products, 650 tons.

The Katsina steel rolling mill's output of 32,000 tons of products was significantly less than the 62,535 tons produced in 1986. Billets were in short supply because of the low value of the Nigerian currency in the foreign exchange market, the lack of spare parts, and the rising cost of energy. New products planned for 1988 were galvanized wire and welding electrodes.

The National Iron Ore Mining Co. produced 240,000 tons of ore during 1987, compared with a projected figure of 410,000 tons. Apparently, adequate funds were unavailable for needed mining haulage and loading equipment.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Columbium and tantalum concentrates, gross weight:					
Columbite	87	120	100	13	48
Tantalite	1	1	1	--	--
Iron and steel: Metal: Steel, crude	140,000	180,000	254,000	200,000	136,00
Lead:					
Mine output, Pb content[e]	260	200	260	100	NA
Metal, refined, secondary	2,000	2,000	3,000	3,500	NA
Tin:					
Mine output, cassiterite concentrate:					
Gross weight (73.5% Sn)	1,560	1,700	1,550	630	[2]844
Sn content	[r]1,600	1,340	1,100	460	603
Metal, smelter	[r]1,400	1,344	1,079	91	560
Zinc ore and concentrate, Zn content	[3]	[3]	1,000	[3]	[3]
INDUSTRIAL MINERALS					
Cement, hydraulic thousand tons	3,600	3,600	3,600	3,860	[e]3,800
Clays:					
Kaolin	700	286	300	[3]	177
Unspecified	20,000	20,000	20,000	15,000	NA
Feldspar[e]	5,000	--	5,000	3,500	485
Stone:					
Limestone thousand tons	1,400	1,890	1,800	1,850	2,627
Marble	3,000	1,200	1,200	1,482	3,500
Shale thousand tons	140	127	120	104	88
MINERAL FUELS AND RELATED MATERIALS					
Coal do	53	76	55	150	110
Gas, natural:					
Gross million cubic feet	655,000	174,000	96,000	72,200	65,992
Marketed do	18,000	18,000	18,000	20,000	47,225
Petroleum:					
Crude thousand 42-gallon barrels	452,000	508,000	544,252	534,165	486,869
Refinery products:					
Gasoline do	11,100	22,000	22,900	18,660	12,050
Jet fuel do	400	400	400	375	490
Kerosene do	6,200	6,400	10,000	8,700	6,750
Distillate fuel oil do	14,547	14,547	17,500	12,400	2,500
Residual fuel oil do	9,990	9,990	11,300	15,300	NA
Unspecified do	1,048	1,563	3,700	4,700	660
Total do	43,285	54,900	65,800	60,135	22,450

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Includes data available through Oct. 5, 1988.
[2]Reported figure.
[3]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Gold.—NMC announced that gold had been found in commercial quantities in Kaduna, Kwara, Niger, Oyo, and Sokoto States. Gold concentrates were being produced and stockpiled in Ilesha, Oyo State. However, sales were not scheduled until refining equipment could be obtained. The gold reserve was estimated at about 120,000 troy ounces.

Exploration at the Iperindo Reef included drilling 1,488 meters in 16 holes within 40 meters of the ground surface, digging over 1,300 pits for sampling, and channel sampling of 2 old adits.

Two hundred and eighty-nine holes were drilled to a cumulative depth of 672 meters in ore blocks B, C, D, F, and O at the Itagunmodi alluvial deposit, and 603 heavy-mineral concentrate samples were collected and amalgamated. The total gold reserve of 11 ore blocks over an area of 94.6 hectares was 186 kilograms (6,000 troy ounces), based on a cutoff grade of 0.02 gram (0.0006 troy ounce) per cubic meter.

At the Okolom alluvial deposit, an area of about 70 square kilometers around the main vein was mapped geologically at a scale of 1:25,000. Also, 1,648 pits were dug to an average pit depth of 1.8 meters over a 30-hectare area for the collection of 2,193 heavy-mineral samples.

Iron and Steel.—The Associated Ores Mining Co. stockpiled for beneficiation over 350,000 tons of low-grade iron ore from the Itakpe Hill Mine. Construction of the platform and excavation of the foundations for the new crushing plant began in December, and a contract was awarded for the construction of a 65-kilometer railway and the supply of locomotives and rolling stock. The contract for the beneficiation plant and the dam at Osara had not yet been signed. Workshops, a warehouse, roads, and a town were also planned.

Construction continued with technical assistance from the Soviet Union on the Ajaokuta Steel Co. Ltd. plant in Kwara State with an expected full commissioning by 1989. Phase 1, consisting mainly of four rolling mills, an oxygen blast furnace, and ancillary facilities, was originally due for completion in 1983. Two rolling mills, the light steel mill and wire rod mill, were commissioned in 1983 and 1984, respectively, and then processed imported billets. During 1987, the light section and bar mill, wire rod mill, mechanical repair shop, forge and fabrication shop, thermal powerplant, compressor house, water treatment plants, and other shops were completed and operational. Work continued on the continuous-production billet mill, 110-megawatt powerplant, and the foundry and pattern-making shops. The capacity of the plant was to be 1.3 million tons annually with the commissioning at the end of 1989 of the main oxygen blast furnace. Dolomite, iron ore, limestone, and refractory clay would come from local sources; calcined bauxite, coking coal, and manganese would initially be imported. A proposed additional plant would produce flat-steel products, which constitutes about one-half of the total steel consumption in Nigeria.

The Niger Steel Co. was to be reactivated under a technical and management agreement with a group of three U.S. companies and Industrial Dynamics Co. of Nigeria. The U.S. consortium was to supply the plants and equipment as well as manage the company.

Lead and Zinc.—The Enyigba lead-zinc-salt mine at Abakaliki, which was inoperative since mid-1984, was to be reopened, and a contract was awarded for a feasibility study.

Tin.—The Makeri Smelting Corp., Nigeria's sole tin metal producer with a capacity of 13,500 tons per year, became totally Government owned after Amalgamated Metal Co. sold its 40% share.

INDUSTRIAL MINERALS

Barite.—Production during 1987 by NMC was 21,019 tons, 12,488 tons, and 4,794 tons from the quarry, crusher, and jig, respectively. Output from the quarry and crusher exceeded goals. A second jig for treating coarse material at the site was completed, and an access road was constructed from Adudu to Azara. Production went to Dresser Nigeria Ltd. and Baroid Drilling Chemical Products Ltd. to be used for oil well drilling.

Clays.—*Bentonite.*—At the Damboa bentonite deposit, samples were collected for analysis from 15 pits along 4,200 meters of grid lines. Clay samples were also collected for testing from deep-water boreholes. The clays in the area may be suitable for the

production of drilling mud.

Brick.—The five operating brick plants produced 20.4 million brick units, which was an improvement over 1986 production. Demand was greater than supply as the preferred building material shifted from cement back to brick.

Kaolin.—Production of crude kaolin at the Major Porter Mine was only 300 tons during 1987 because operations were suspended for most of the year to await the commissioning of the washing plant.

Refractory.—NMC analyzed 78 split-core samples and also bulk samples from the Giro clay deposit. Analytical results show that the clay had high aluminum oxide and low ferrous oxide content.

Cement.—The United Nations Industrial Development Organization (UNIDO) agreed to provide technical assistance and managerial support to improve performance of the 600,000-ton-per-year cement plant owned by Cement Co. of Northern Nigeria (CCNN) at Sokoto. The cost of $4.8 million was to be paid by CCNN. Nigerian personnel would be trained to replace UNIDO personnel by 1989.

West African Portland Cement Co. (Wapco) increased turnover and profits during the first half of 1987 after a 9% increase in sales volume in 1986 and an increase in selling prices. Profits increased from $2.5 million to $5.4 million.

Diatomite.—At the Bularaba diatomite mine, 1,600 tons of crude diatomite ore was mined and stockpiled while calcination test work was being done in Kenya.

About 1 square kilometer of ground surrounding the main diatomite outcrop in Abakire was investigated. Work included geological mapping, surveying, drilling, sampling, and laboratory analysis.

Feldspar and Quartz.—Production at the Lokoja quarry was 2,494 tons of feldspar and 1,282 tons of quartz; at the crusher, production was 1,527 tons and 860 tons of feldspar and quartz, respectively. Production was less than expected because of a shortage of machinery and inadequate geological information.

Trenching of vein 5 at Lokja showed the need for a drilling program. Seventeen boreholes were drilled on veins 1 and 4 with a cumulative depth of 194 meters. The results compared favorably with those of the vein being exploited.

Fertilizer Materials.—At midyear, the National Fertilizer Co. of Nigeria Ltd. exported 8,000 tons of ammonia to Spain, representing the first production from the new 272,000-ton-per-year ammonia plant at Onne, near Port Harcourt. The urea unit came on-stream in September, but startup of the 300,000-ton-per-year compound fertilizer plant at the site was delayed until 1988 because foreign exchange was unavailable to procure the phosphate and potash inputs.

Granite.—NMC continued to supply aggregate for construction purposes, but decreasing local demand forced the temporary closure of some quarries. The lack of spare parts and replacement equipment precluded increases in production where demand was high.

Salt.—NNPC evaluated its Oku Lake seismic data and held meetings with NMC for a possible joint-venture to explore for salt in the Oku Lake structure. A 2,100-meter borehole was being considered by these groups.

MINERAL FUELS

Coal.—Several private companies were licensed by the Government to mine coal, including the local companies Mosheshie General Merchants (MGM), Suliaswua Enterprises, and Yulako Investment Co., with concessions at Owukpa in Benue State. Italco-Avice Services, jointly owned by Italy and Nigeria, began mining coal at Owukpa in early 1986. The Government was also considering applications for concessions at Enugu and Benue from 10 other Nigerian and joint-venture companies.

Petroleum.—*Exploration.*—Exploration momentum continued upward since the 4-year downward trend ended in early 1986. Nineteen exploratory wells were drilled in 1987; 22 were drilled in 1986. The number of appraisal and development wells drilled increased from 53 in 1986 to 65 in 1987. The Shell Petroleum Development Co. of Nigeria made two major oil discoveries in Bendel State. Exploration at Gbetiokun I established preliminary reserves of more than 50 million barrels after drilling penetrated 420-foot-thick oil sands and 31-foot-thick gas sands in different reservoirs. An Opomoyo I exploration well penetrated 221-foot-thick oil sands and 43-foot-thick gas sands; the initial reserve estimate was more than 30 million barrels.

Mobil Producing Nigeria, operator of the Mobil-Nigerian National Petroleum Corp. (NPN) joint venture, discovered the Inuen offshore oilfield 30 miles south of NPN's Qua Iboe terminal in southeast Nigeria. The Inuen-1 well, in 176 feet of water, produced 4,600 bbl/d of 38-API oil. In the

same area, the Iyak-3 appraisal well tested oil at a northwestern extension to southeastern Iyak field, 26 miles of Qua Iboe, and 2,700 bbl/d of 36-API oil flowed through a 1/2-inch choke.

NNPC made a noncommercial oil and gas discovery in the northern State of Borno at Gaji Ganna, near Maiduguri, after 10 years of exploration. A total of 10 wells were to be drilled by yearend in the remote region.

Refineries.—Progress was made toward the completion of Nigeria's fourth refinery being built at Alesa-Eleme near Port Harcourt. The $500 million project, undertaken by a Japanese-French consortium, was to have a capacity of 150,000 bbl/d. The new refinery would elevate Nigeria's total nameplate refining capacity to 435,000 bbl/d.

Transportation.—NNPC planned to lay a second oil pipeline across the Escravos River because of a crack in the existing 376-mile-long, 36-inch System 2C line that moves oil to the Kaduna refinery from Escravos.

Petrochemicals.—Two new petrochemical plants were to be commissioned at yearend as the first phase of Nigeria's new petrochemical industry. The Warri complex was to begin producing 37,000 tons per year of polypropylene and 18,000 tons per year of carbon black. The Kaduna plant would produce 30,000 tons per year of linear alkyl benzene.

SRI International completed its feasibility study on the petrochemicals industry for NNPC and recommended a project costing an initial $453 million, which would increase to $615 million after expansion. Proposed annual production was ethylene, 170,000 tons, with possible expansion to 260,000 tons; polyethylene, 164,000 tons, with possible expansion to 250,000 tons; and polypropylene, 80,000 tons. A $213 million natural gas liquids plant was also recommended.

Natural Gas.—NNPC awarded a $310 million turnkey contract to Saipem S.p.A. and to Snamprogetti S.p.A. of Italy to lay gas pipelines to develop the Warri Gasfield. The group was to supply design, materials, and equipment, and construct the 236-mile, 36-inch network by mid-1988 from Warri to an electric powerplant at Egbin, near Lagos. However, Nigeria failed to get a World Bank loan for construction because it did not conform to competitive bidding requirements.

NNPC, Shell Gas BV, and units of Société Nationale Elf Aquitaine and AGIP S.p.A agreed to form a project company early in 1988 that would build a 4.6-million-ton-per-year, two-train liquefied natural gas (LNG) plant at Bonny, which was a scaled-down version of an earlier proposal. The plant would liquefy gas provided by the four participants from onshore concessions and would begin shipping the LNG to Europe in 1995. The plan also included four LNG carriers, each with a capacity of 135,000 cubic meters. Given Nigeria's debt problems and the unfavorable condition of the world market, financing remained a significant problem. NNPC worked during the year to acquire firm commitments from buyers. Expressions of interest came from Belgium, France, the Federal Republic of Germany, Italy, and Spain.

NNPC announced that it planned to spend $106 million on a program to increase LPG production and set up a major distribution system that would provide a cheap fuel for Nigerian household, thereby reducing demand for kerosene and firewood. A 116,000-barrel-per-year LPG Merox plant would be built at the 90,400-bbl/d Kaduna refinery. The distribution infrastructure would comprise eight LPG storage depots at Lagos, Gombe, Calabar, Enugu, and Ibadan. NNPC would need four main-line locomotives, 150 rail cars, and 4 brake vans to transport the LPG.

Uranium.—Exploration for uranium in Mikat and Michika areas of Gongola State continued by Nigerian Uranium Mining Co., which was owned 60% by NMC and 40% by Total Compagnie Minière of France.

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[1]Physical scientist, Division of International Minerals.
[2]International Mining. Aug. 1987, p. 88.

The Mineral Industry of Norway

By Richard H. Singleton[1]

Norwegian aluminum and zinc production reached record highs during 1987 after 2 years of contraction. Expansion of the country's only nickel refinery was completed during the year. Two of six pig iron furnaces were closed, and coke production decreased, as the steel industry became more dependent on scrap as raw material. The state-owned steel industry continued to operate at a loss, and rationalizations were being planned to return to profitable operation. One silicon plant was closed and production at another was halved in response to world overcapacity and to low world prices and demand, especially in Western Europe. Imports of manganese ore from the Republic of South Africa for Norway's large ferroalloys industry were excluded for at least 2 years from Norway's trade sanctions against the Republic of South Africa. A new gallium recovery plant for production of gallium for export became operational. Scandium exploration and deposit evaluation began and a pilot plant for production of high-purity oxide went onstream. A copper-zinc mine closed because of reserves depletion, a Government-subsidized iron mine closed because of lean ores, and a loss-producing zinc mine closed. A new shipping terminal, completed in 1986 for export of iron ore, was closed because of an underwater landslide.

Construction began on a graphite-flake concentrator to replace Norway's sole graphite plant that had been destroyed by fire in 1985. Technical problems delayed startup of a new high-purity quartz plant. Equipment problems prevented the new TiO_2-slag plant from reaching more than 20% of its capacity, and the plant was closed near yearend.

Production of crude oil and natural gas, all from the Norwegian sector of the North Sea, reached record highs in 1987 even though the Government continued to limit oil production at 8% below capacity in response to world production restraints called for by the Organization of Petroleum Exporting Countries (OPEC). Norway was not a member of OPEC. Proven reserves of crude oil, which decreased for the first time, were estimated to be sufficient for 17 years of production at the current production rate. Other estimated resources were sufficient to permit current annual production until about the year 2020. New estimates of gas reserves in the Frigg area, which accounted for 43% of Norway's gas production in 1987, indicated that this source would be depleted by yearend 1990. All of the Frigg area gas was exported to the United Kingdom. However, reserves of offshore gas appeared to be sufficient for about 80 years at 1987 production rates. Development of the Gullfaks and Oseberg Oilfields continued. In a major engineering feat, five platforms of the Ekofisk oil production complex were elevated simultaneously in August to prevent submergence of critical operations as a result of seabed subsidence.

Two oilfields and one gasfield received development approval from the Government. Gas from the Tommelitin Gasfield was to be injected into the Ekofisk Oilfield beginning in 1988 in order to boost production. Engineering design was begun for the platforms of the very large Sleipner and Troll Gasfields mainly to supply gas to the Western European mainland. Development plans for five new oilfields in the North Sea and in the Norwegian Sea were submitted by industry for Government approval. The Government presented a report for Parliamentary approval that would define policy

for limiting and prioritizing offshore oil and gas development. Developments in the Norwegian Sea including the Haltenbanken area were expected to be more costly than in the North Sea and especially dependent on attainment of a market for the gas coproduct. Exploration for petroleum in offshore Norway continued at the same level as in 1986 and included the North Sea, the Norwegian Sea, and the Barents Sea off the northern Arctic coast. Five wildcat wells drilled in the Barents Sea produced only one small gas find.

The minerals industry was estimated to account for approximately 15% of Norway's 1987 gross domestic product (GDP). A breakdown by value of the $12 billion[2] minerals industry in 1987 is primary fuels, 74%; primary metals, 24%; and industrial minerals, 2%. Approximately 90% of the total products of these industries was exported, mostly to Western Europe. The United States received about 5% of Norwegian mineral exports, mainly as crude petroleum, steel, and nickel, in order of value. Crude oil accounted for approximately 70% of the value of mineral fuels production; natural gas accounted for the balance, except for a small amount, 0.4%, of mined coal. A breakdown by value of the $2.9 billion metals-mining and -smelting industry was primary aluminum, 40%, ferroalloys, 20%; primary steel, 15%; and magnesium and nickel, about 6% each. Approximately two-thirds of the value of industrial minerals was accounted for by the cement, olivine, and ammonia industries, in order of value.

The national economy weakened somewhat and the real GDP increased by only 1%. Falling tax revenues from the North Sea petroleum industry, which continued to be plagued by declining product prices, and a generally weak onshore economy, including the nonfuel mineral industries, contributed to the malaise. However, the real value of exported goods increased by 8%, whereas the value of imported goods stabilized. Although private consumption fell, inflation increased to 9%. Wages increased by 12% and unemployment rose slightly to 2.1%. Total investment decreased slightly but remained high, 27% of the GDP, although it dropped by 9% in the offshore petroleum industry. Net foreign debt, already high, increased to 17% of the GDP. The unadjusted 1987 GDP was $83 billion. The Government continued its attempts to hold down inflation by limiting interest rates and attempting to contain wage increases.

PRODUCTION

Production of primary aluminum, nickel, and zinc each increased significantly. Expansions in aluminum- and zinc-smelting capacities had been completed in 1986. Decreases in iron ore and zinc concentrate production were caused by mine closures. Closures of pig iron furnaces caused reduced production of pig iron and coke. Production of primary copper decreased.

Production increases for ammonia and nepheline syenite were accompanied by decreased olivine production.

Production of North Sea crude oil increased significantly and natural gas production increased somewhat less. Production of oil refinery products increased in response to domestic demand.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS					
Aluminum:					
Primary	713,014	765,083	742,686	725,813	806,092
Secondary	4,558	5,587	6,004	[e]6,000	[e]6,000
Cadmium, smelter	117	150	159	154	147
Cobalt	879	1,191	1,637	1,574	1,576
Copper:					
Mine output, Cu content	22,568	25,042	[r]18,969	21,887	21,984
Metal, primary plus secondary:					
Smelter	25,658	36,821	37,828	35,202	29,701
Refined	22,705	30,323	31,074	30,457	29,386

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS —Continued					
Iron and steel:					
Ore and concentrate:					
Gross weight ____ thousand tons	3,545	3,837	3,497	3,618	3,140
Fe content ____ do ____	2,307	2,500	2,321	2,377	e2,060
Metal:					
Pig iron ____ do ____	565	546	596	560	365
Ferroalloys:					
Ferrochromium[e] ____	4,000	--	--	--	--
Ferromanganese ____	283,492	285,169	267,670	195,257	191,992
Ferrosilicochromium[e] ____	400	--	--	--	--
Ferrosilicomanganese ____	194,784	280,953	256,457	223,490	237,277
Ferrosilicon (75% basis) ____	368,817	437,164	397,776	335,041	336,168
Other[e] ____	4,630	--	--	--	--
Total ____	856,123	1,003,286	921,903	753,788	765,437
Steel, crude ____ thousand tons	895	920	958	836	837
Semimanufactures, rolled ____ do ____	561	615	664	687	e700
Lead, mine ouput, Pb content ____	4,309	3,967	3,597	3,366	e3,000
Magnesium, primary ____	29,844	49,301	54,704	56,864	56,907
Nickel:					
Mine output, Ni content ____	360	325	425	438	496
Metal, primary ____	28,619	35,548	37,513	38,202	44,565
Platinum-group metals[2] ____ troy ounces	40,832	44,529	44,079	51,440	e50,000
Silicon metal ____	76,856	89,398	105,552	e100,000	e90,000
Zinc:					
Mine output, Zn content ____	32,356	28,513	27,352	27,508	22,164
Metal, primary ____	90,668	94,248	92,762	90,475	116,468
INDUSTRIAL MINERALS					
Cement, hydraulic ____ thousand tons	1,666	1,547	1,343	1,625	1,639
Feldspar ____	57,960	67,820	80,095	87,257	e90,000
Gallium[e] ____ kilograms	--	--	--	--	1,000
Gold[e] ____ troy ounces	--	--	300	3,000	30,000
Graphite ____	8,063	10,067	2,684	--	--
Lime, hydrated and quicklime[e] thousand tons	130	130	100	100	100
Mica, flake[e] ____	4,000	4,000	4,000	3,000	3,000
Nepheline syenite ____ thousand tons	220	226	227	218	242
Nitrogen: N content of ammonia ____ do ____	513	636	458	300	347
Olivine sand ____ do ____	1,354	1,772	1,989	2,537	1,912
Pyrite ____ do ____	357	428	395	380	358
Stone, crushed:					
Dolomite ____ do ____	422	534	555	e550	e550
Limestone ____ do ____	4,303	3,995	3,827	e4,000	e4,000
Quartz and quartzite ____ do ____	582	828	775	e800	e800
Sulfur:					
Pyrite, S content ____ do ____	r220	203	193	181	e180
Byproduct of:					
Metallurgy ____ do ____	r e54	62	60	67	e85
Petroleum ____ do ____	8	8	10	e13	e10
Total ____ do ____	282	273	263	261	e275
Talc, soapstone, steatite[e] ____ do ____	100	3113	100	100	100
Titania:					
Ilmenite concentrate ____ do ____	556	652	736	802	852
TiO_2 content ____ do ____	247	289	327	357	378
MINERAL FUELS AND RELATED MATERIALS					
Coal, all grades ____ thousand tons	502	451	507	437	448
Coke, all grades ____ do ____	314	337	r313	313	284
Gas:					
Manufactured ____ million cubic feet	171	73	--	--	--
Natural:					
Gross ____ billion cubic feet	e1,000	1,144	1,202	1,119	1,216
Marketable[4] ____ do ____	932	964	983	973	1,076
Marketed[5] ____ do ____	912	944	898	829	998
Peat:[e]					
For agriculture ____ thousand tons	30	30	30	30	30
For fuel ____ do ____	1	1	1	1	1

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum:					
Crude[6] thousand 42-gallon barrels	217,900	251,500	[r]276,700	295,700	344,000
Natural gas liquids do	15,590	14,730	[r]16,440	21,720	22,470
Refinery products:					
Naphtha do	4,311	3,429	[r]3,834	3,618	4,419
Gasoline do	10,124	11,849	[r]11,466	10,548	12,248
Kerosene do	4,526	4,687	[r]5,906	5,549	6,402
Distillate fuel oil do	25,110	24,767	[r]26,811	27,199	33,756
Residual fuel oil do	5,641	6,693	[r]4,942	5,934	6,973
Other do	3,568	3,972	[r]3,897	3,380	4,050
Refinery fuel and losses do	3,074	3,642	[r]4,277	3,823	3,795
Total do	56,374	59,039	[r]61,133	60,051	71,643

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available Sept. 15, 1988.
[2]Data represent exports, part of which may be derived from imported materials.
[3]Reported figure.
[4]Gross less gas reinjected and flared.
[5]Marketable less gas used as fuel during production for 1983. Reported as total methane sales after 1983.
[6]Excluding natural gas liquids. The crude oil entry in the 1985 Norway chapter included natural gas liquids content.

TRADE

Primary mineral products were approximately 50% of the value of Norway's exported goods in 1987. Of this, about 75% was North Sea crude petroleum and natural gas and most of the balance was metal products, valued at the primary metal stage or earlier in the production sequence. Essentially all of the natural gas and about 85% of crude oil production were exported. Natural gas made up 32% of the value of the petroleum export component, compared with 47% in 1986. The main cause of this decrease was a 35% drop in the average 1987 price of gas and only a 10% increase in the price of crude oil. These changes were accompanied by an 18% increase in the volume of oil exports and an 8% increase in the volume of gas exports. Primary aluminum was about 40% of the total value of exported metals.

Export of goods to the United States increased in real value by 15% to a current value of about $1.5 billion. Of this, 9% was crude oil, about 27 million barrels. U.S. export of goods to Norway decreased in real value by 18% to a current value of $0.8 billion.

Table 2.—Norway: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	--	60	--	All to Sweden.
Oxides and hydroxides	915	12,642	--	United Kingdom 10,102; Netherlands 1,506; Sweden 1,002.
Metal including alloys:				
Scrap	28,725	31,126	--	West Germany 11,613; Sweden 7,952; Finland 3,984.
Unwrought	643,790	646,539	4,209	West Germany 195,054; United Kingdom 119,549; Netherlands 105,813.
Semimanufactures	82,445	85,833	5,004	United Kingdom 19,227; Sweden 10,066; France 8,755.

See footnote at end of table.

Table 2.—Norway: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Beryllium: Metal including alloys, all forms	3	--		
Chromium: Oxides and hydroxides	5	--		
Cobalt: Oxides and hydroxides	--	(2)	--	All to Malaysia.
Copper:				
Ore and concentrate	82,851	106,237	--	West Germany 49,602; Finland 42,491; Sweden 14,144.
Metal including alloys:				
Scrap	5,257	7,316	--	West Germany 3,964; Italy 838; Sweden 816.
Unwrought	34,308	34,558	509	West Germany 11,190; United Kingdom 9,598; Sweden 5,059.
Semimanufactures	3,853	2,640	19	Sweden 841; United Kingdom 508; West Germany 394.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	2,578	2,532	--	West Germany 1,010; United Kingdom 790; France 346.
Pyrite, roasted do	107	8	(2)	Denmark 2; Sweden 2; West Germany 1.
Metal:				
Scrap	9,301	7,704	3	Sweden 2,201; Denmark 1,991; West Germany 1,336.
Pig iron, cast iron, related materials	32,201	22,898	--	United Kingdom 16,105; Sweden 4,115; Denmark 1,247.
Ferroalloys:				
Ferromanganese	180,018	162,175	5,308	West Germany 24,297; United Kingdom 23,213; Sweden 22,909.
Unspecified	607,846	553,316	49,018	West Germany 153,057; Japan 78,636; United Kingdom 64,455.
Steel, primary forms	143,803	41,353	--	Netherlands 27,175; United Kingdom 9,976; Sweden 2,525.
Semimanufactures:				
Bars, rods, angles, shapes, sections	354,015	299,127	49,494	West Germany 61,957; Italy 34,505.
Universals, plates, sheets	173,210	150,097	11,792	Sweden 35,459; United Kingdom 32,344; Denmark 26,829.
Hoop and strip	13,971	16,350	--	Sweden 14,442; Denmark 1,490; West Germany 146.
Rails and accessories	879	2,223	(2)	West Germany 1,000; United Kingdom 498; Netherlands 412.
Wire	8,683	9,798	1,646	United Kingdom 1,226; West Germany 1,172.
Tubes, pipes, fittings	65,641	56,428	5,288	Sweden 27,896; Denmark 5,872.
Castings and forgings, rough	4,602	3,198	1	Sweden 2,852; Denmark 252; United Kingdom 43.
Lead:				
Ore and concentrate	6,686	7,180	--	All from West Germany.
Oxides	3	16	--	Malaysia 6; Turkey 6; Denmark 2.
Metal including alloys:				
Scrap	6,475	7,171	--	Sweden 6,571; West Germany 234; Netherlands 181.
Unwrought	44	28	--	Sweden 26; Austria 2.
Semimanufactures	1	1	--	All to Gambia.
Magnesium: Metal including alloys:				
Scrap	22	103	--	West Germany 102; Sweden 1.
Unwrought value, thousands	$136,476	$146,530	NA	NA.
Semimanufactures	30	164	98	West Germany 36; Sweden 27.
Manganese: Ore and concentrate, metallurgical-grade	--	505	--	All to Sweden.
Mercury 76-pound flasks	1,653	870	--	Spain 841.
Molybdenum: Metal including alloys, all forms	1	1	--	NA.

See footnotes at end of table.

Table 2.—Norway: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Nickel:				
Ore and concentrate	10,843	11,871	--	Finland 11,848; West Germany 23.
Metal including alloys:				
Scrap	143	108	65	West Germany 20; United Kingdom 14.
Unwrought	35,666	37,917	16,821	Netherlands 5,591; West Germany 3,922.
Semimanufactures	17	30	--	Netherlands 11; Finland 7; Denmark 4.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$11,622	$16,260	$107	West Germany $11,273; Sweden $3,769; United Kingdom $605.
Silver:				
Waste and sweepings[3] do	$1,949	$2,761	--	West Germany $2,399; United Kingdom $342; Sweden $9.
Metal including alloys, unwrought and partly wrought do	$4,969	$6,141	$15	Sweden $2,734; Denmark $1,016; Canada $842.
Tin: Metal including alloys:				
Scrap	21	12	--	Belgium-Luxembourg 5; Sweden 3; United Kingdom 3.
Unwrought	9	5	--	Sweden 4; United Kingdom 1.
Semimanufactures	13	23	--	West Germany 21; Singapore 1.
Titanium: Oxides	3,245	1,253	--	Sweden 958; Denmark 197; Finland 21.
Tungsten: Metal including alloys, all forms	3	(2)	--	Mainly to Sweden.
Zinc:				
Ore and concentrate	10,959	8,355	--	All to West Germany.
Oxides	3,133	3,004	--	United Kingdom 1,852; West Germany 502; Sweden 261.
Metals including alloys:				
Scrap	308	539	--	Sweden 251; United Kingdom 201; West Germany 47.
Unwrought	78,639	77,235	11,941	Sweden 18,110; West Germany 16,363; United Kingdom 14,075.
Semimanufactures	6,547	6,636	--	West Germany 1,138; Netherlands 879; Denmark 651.
Other:				
Ores and concentrates	641,910	693,265	--	West Germany 250,537; Finland 164,111; United Kingdom 96,984.
Ashes and residues value, thousands	$53,521	$38,901	$476	Republic of South Africa $33,382; Canada $1,555; Belgium-Luxembourg $1,496.
Base metals including alloys, all forms	1,681	1,859	883	Netherlands 405; Japan 173.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	70	22	--	Iceland 20; Sweden 1.
Artifical: Corundum	10	4	--	West Germany 1; Netherlands 1; Sweden 1.
Dust and powder of precious and semiprecious stones including diamond value, thousands	--	$4	--	All to Sweden.
Grinding and polishing wheels and stones	878	690	60	Finland 153; Sweden 148.
Asbestos, crude	--	1	--	All to Netherlands.
Barite and witherite	8,801	10,053	--	Denmark 6,854; United Kingdom 3,001; Sweden 141.
Boron materials: Oxides and acids	7	--		
Cement	35,632	653	NA	NA.
Chalk	--	3	--	Algeria 1.
Clays, crude	437	103	--	Denmark 72; Sweden 14; United Kingdom 13.
Cryolite and chiolite	2	2	--	All to Sweden.
Diamond:				
Gem, not set or strung value, thousands	$546	$103	--	Belgium-Luxembourg $45; West Germany $33; Switzerland $10.
Industrial stones do	--	$13	--	All to Finland.

See footnotes at end of table.

Table 2.—Norway: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Diatomite and other infusorial earth value, thousands	$2	$6	--	All to West Germany.
Feldspar, fluorspar, related materials	316,662	302,847	--	Netherlands 88,067; United Kingdom 63,679; West Germany 59,370.
Fertilizer materials:				
Crude, n.e.s	6	1	--	All to West Germany.
Manufactured:				
Ammonia value, thousands	$4,619	$1,608	NA	NA.
Nitrogenous do	$87,194	$81,677	NA	NA.
Potassic do	--	$3	--	All to West Germany.
Unspecified and mixed do	$148,906	$155,247	NA	NA.
Graphite, natural	6,161	954	NA	NA.
Gypsum and plaster	36	29	--	Sweden 17; Denmark 12.
Lime	822	4,860	--	Liberia 3,500; Denmark 1,124; Sweden 201.
Magnesium compounds	10,271	8,689	NA	NA.
Mica:				
Crude including splittings and waste	1,934	1,422	--	Netherlands 416; West Germany 320; Sweden 140.
Worked including agglomerated splittings	(2)	(2)	--	NA.
Phosphates, crude	51	--		
Pigments, mineral: Iron oxides and hydroxides, processed	18	44	19	Thailand 11; Singapore 8.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$160	$40	--	Denmark $23; Hong Kong $6; Belgium-Luxembourg $4.
Synthetic do	$44	$4	--	All to Denmark.
Pyrite, unroasted	169,308	172,650	--	Italy 69,856; West Germany 62,971; Sweden 38,584.
Salt and brine value, thousands	$167	$237	--	West Germany $108; Sweden $97; Denmark $23.
Sodium compounds, n.e.s.: Carbonate, manufactured	11	23	--	United Kingdom 22.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked thousand tons	212	270	1	Netherlands 119; West Germany 42; France 29.
Worked do	12	12	(2)	Netherlands 9; Sweden 1.
Dolomite, chiefly refractory-grade do	168	168	NA	NA.
Gravel and crushed rock do	3,490	4,120	192	West Germany 1,629; Netherlands 531; Denmark 465.
Limestone other than dimension do	9	4	--	Mainly to United Kingdom.
Quartz and quartzite do	93	124	--	Iceland 111; Denmark 9; United Kingdom 2.
Sand other than metal-bearing value, thousands	$386	$376	$25	United Arab Emirates $161; West Germany $83; Japan $63.
Sulfur:				
Elemental:				
Crude including native and by-product	3,722	2,643	--	United Kingdom 1,812; France 793; Sweden 34.
Colloidal, precipated, sublimed	1,317	2,751	--	Sweden 1,869; United Kingdom 882.
Sulfuric acid value, thousands	$7,045	$8,283	NA	NA.
Talc, steatite, soapstone, pyrophyllite	44,435	42,702	--	United Kingdom 10,486; Netherlands 9,124; West Germany 7,915.
Other:				
Crude	68	788	--	Sweden 442; Netherlands 203; Denmark 70.
Slag and dross, not metal-bearing	6,508	17,698	76	Denmark 12,740; Sweden 4,502; Singapore 156.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	6	1,565	--	Sweden 1,384; Iceland 169; United Kingdom 9.
Carbon black	37	6	--	Sweden 4; Denmark 1; Malaysia 1.
Coke and semicoke	122,270	124,984	--	Netherlands 37,266; Sweden 27,564; Iceland 22,450.

See footnotes at end of table.

Table 2.—Norway: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Gas, natural: Gaseous[4] million cubic feet	898,012	905,923	--	West Germany 454,180; United Kingdom 451,743.
Peat including briquets and litter	33	385	--	All to United Kingdom.
Petroleum:				
Crude thousand 42-gallon barrels	240,790	264,366	13,009	United Kingdom 148,962; Netherlands 34,781; Sweden 21,906.
Refinery products:				
Liquefied petroleum gas[4] do	1,636	1,578	174	Denmark 406; Netherlands 325.
Gasoline do	5,463	5,302	153	Sweden 2,089; United Kingdom 1,712; Netherlands 350.
Mineral jelly and wax do	2	(2)	--	Mainly to Sweden.
Kerosene and jet fuel do	1,667	1,634	--	Denmark 526; Netherlands 231; United Kingdom 228.
Distillate fuel oil do	5,171	5,230	--	Denmark 3,054; West Germany 1,091; Sweden 310.
Lubricants do	40	47	(2)	Sweden 22; Netherlands 17; Denmark 4.
Residual fuel oil do	7,631	6,318	984	France 1,095; West Germany 1,068.
Bitumen and other residues do	1	24	--	Sweden 23; Spain 1.
Bituminous mixtures do	(2)	4	--	Mainly to United Kingdom.
Petroleum coke do	464	446	--	Netherlands 354; United Kingdom 54; Yugoslavia 19.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.
[4]International Energy Agency.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	5,590	5,871	--	Greece 5,850; United Kingdom 21.
Oxides and hydroxides thousand tons	1,479	1,496	26	Suriname 469; Australia 451; Ireland 201.
Metal including alloys:				
Scrap	2,127	3,213	--	Denmark 2,119; Sweden 514; West Germany 362.
Unwrought	34,679	35,118	24	Brazil 10,194; U.S.S.R. 9,002; Sweden 3,494.
Semimanufactures	47,535	54,410	155	West Germany 24,965; Sweden 7,561; Belgium-Luxembourg 3,837.
Beryllium: Metal including alloys, all forms	--	(2)	(2)	Mainly from Sweden.
Chromium:				
Ore and concentrate	110	520	--	Greece 450; Finland 60; Netherlands 10.
Oxides and hydroxides	87	152	--	West Germany 110; China 20; Italy 10.
Cobalt: Oxides and hydroxides	9	1	--	All from Austria.
Columbium and tantalum: Metal including alloys, all forms, tantalum	(2)	(2)	--	Mainly from Sweden.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Copper:				
Ore and concentrate	1,972	--		
Matte and speiss including cement copper	2,488	584	--	Zimbabwe 518; Sweden 46; Finland 21.
Metal including alloys:				
Scrap	526	56	1	Sweden 54; United Kingdom 1.
Unwrought	2,717	3,080	(2)	West Germany 1,575; United Kingdom 543; Sweden 516.
Semimanufactures	28,773	31,352	54	West Germany 8,653; Sweden 8,549; Belgium-Luxembourg 8,208.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	230,175	17,715	--	All from Sweden.
Metal:				
Scrap	10,831	6,145	15	Denmark 2,355; Sweden 2,301; West Germany 1,117.
Pig iron, cast iron, related materials	8,671	7,432	1	Sweden 2,811; West Germany 1,112; United Kingdom 1,045.
Ferroalloys:				
Ferromanganese	(2)	--		
Unspecified	2,844	2,389	55	Sweden 992; West Germany 603; United Kingdom 526.
Steel, primary forms	142,511	131,162	1	Netherlands 53,474; West Germany 48,216; France 14,494.
Semimanufactures:				
Bars, rods, angles, shapes, sections	226,030	276,329	26	Sweden 61,282; West Germany 57,930; France 34,297.
Universals, plates, sheets	540,243	517,587	157	Sweden 110,732; West Germany 80,716; Belgium-Luxembourg 72,930.
Hoop and strip	36,515	36,148	4	West Germany 15,273; Sweden 8,919; Austria 3,098.
Rails and accessories	17,402	17,407	--	Sweden 12,528; West Germany 3,423; United Kingdom 884.
Wire	18,372	20,047	7	Belgium-Luxembourg 8,408; Sweden 6,395; France 1,653.
Tubes, pipes, fittings	192,656	200,530	801	West Germany 48,303; United Kingdom 34,668; France 23,942.
Castings and forgings, rough	3,634	5,429	19	Denmark 1,930; Sweden 1,591; Finland 693.
Lead:				
Oxides	412	175	1	West Germany 142; France 17; United Kingdom 15.
Metal including alloys:				
Scrap	104	--		
Unwrought	13,790	14,231	--	Sweden 11,199; United Kingdom 2,802; West Germany 117.
Semimanufactures	2,593	2,763	(2)	Belgium-Luxembourg 1,227; Netherlands 919; West Germany 506.
Magnesium: Metal including alloys:				
Scrap	22	--		
Unwrought	280	360	321	Sweden 26; Switzerland 12.
Semimanufactures	17	64	1	West Germany 33; Sweden 21; Netherlands 5.
Manganese:				
Ore and concentrate, metallurgical-grade	703,794	817,544	20,707	Republic of South Africa 332,423; Gabon 265,300; France 61,633.
Oxides	972	1,290	3	Netherlands 1,059; Belgium-Luxembourg 96; United Kingdom 92.
Mercury 76-pound flasks	377	87	--	West Germany 80; Sweden 4; Turkey 3.
Molybdenum: Metal including alloys, all forms	1	7	(2)	Spain 5.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Nickel:				
Matte and speiss	102,449	101,073	1,308	Canada 68,754; Republic of South Africa 29,014.
Metal including alloys:				
Scrap	3	12	--	All from United Kingdom.
Unwrought	189	154	33	United Kingdom 51; Canada 32.
Semimanufactures	250	292	18	West Germany 120; United Kingdom 101; Sweden 18.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$4,980	$6,246	$247	West Germany $1,796; Switzerland $1,485; United Kingdom $1,272.
Silver:				
Waste and sweepings[3] do	$2,283	$4,525	--	Sweden $3,914; Turkey $230; Finland $196.
Metal including alloys, unwrought and partly wrought do	$9,634	$10,063	$9	Sweden $3,042; West Germany $2,695; United Kingdom $2,588.
Tin: Metal including alloys:				
Scrap	--	1	--	All from United Kingdom.
Unwrought	482	562	--	United Kingdom 303; Netherlands 87; Sweden 81.
Semimanufactures	153	185	(2)	West Germany 85; United Kingdom 56; Sweden 23.
Titanium, oxides	1,334	1,668	--	West Germany 1,371; Netherlands 224; Belgium-Luxembourg 50.
Tungsten: Metal including alloys, all forms	2	2	(2)	United Kingdom 1.
Zinc:				
Ore and concentrate	104,461	110,468	--	Sweden 69,036; Canada 24,725; Ireland 11,768.
Oxides	2,296	2,503	--	East Germany 1,914; West Germany 346; Sweden 167.
Metal including alloys:				
Scrap	5,551	5,900	--	Denmark 2,648; Finland 1,612; Sweden 1,529.
Unwrought	819	377	--	Finland 115; Sweden 99; Netherlands 90.
Semimanufactures	900	1,012	(2)	France 295; West Germany 282; Netherlands 238.
Other:				
Ores and concentrates	276	3,926	--	Sweden 3,828; Finland 24; Australia 22.
Ashes and residues	255,911	266,610	116	West Germany 197,197; West Germany 50,002; Sweden 18,019.
Base metals including alloys, all forms	2,289	1,835	331	Belgium-Luxembourg 501; Netherlands 211; Republic of South Africa 200.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural, corundum, emery, pumice, etc	10,807	12,420	53	Iceland 10,924; Greece 850; West Germany 278.
Artificial: Corundum	999	610	(2)	West Germany 447; Austria 77; France 44.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$7	$11	$10	NA.
Grinding and polishing wheels and stones	1,044	1,046	7	West Germany 300; Austria 247; Sweden 169.
Asbestos, crude	1	1	--	All from West Germany.
Barite and witherite	124,048	116,489	--	Morocco 96,489; Ireland 17,000; Spain 2,008.
Boron materials:				
Crude natural borates	16	25	25	
Oxides and acids	266	388	NA	NA.
Cement	243,326	559,886	49	Sweden 230,681; Ireland 105,280; Poland 79,351.
Chalk	8,352	8,044	12	Denmark 4,380; Sweden 2,648; France 686.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Clays, crude	144,932	144,327	6,888	United Kingdom 86,538; Greece 17,269; Czechoslovakia 7,236.
Cryolite and chiolite	4,002	4,848	204	Denmark 2,792; Greenland 1,500; Netherlands 214.
Diamond:				
Gem, not set or strung value, thousands	$2,008	$3,545	$69	Belgium-Luxembourg $2,187; United Kingdom $651; Switzerland $240.
Industrial stones do.	$28	$280	$3	Belgium-Luxembourg $265; Netherlands $9.
Diatomite and other infusorial earth	2,177	1,986	113	Iceland 1,076; Denmark 347; United Kingdom 132.
Feldspar, fluorspar, related materials	47,320	47,209	--	Morocco 18,858; Spain 18,531; East Germany 4,752.
Fertilizer materials:				
Crude, n.e.s	38	1	--	All from West Germany.
Manufactured:				
Ammonia	114,816	231,409	16,609	U.S.S.R. 70,877; Trinidad and Tobago 58,452; Netherlands 35,995.
Nitrogenous	4,126	12,085	(2)	Netherlands 9,847; Sweden 1,757; Austria 209.
Phosphatic	2,838	2,568	--	Sweden 2,404; Netherlands 148; Belgium-Luxembourg 10.
Potassic	343,693	317,670	18	West Germany 76,345; Spain 60,665; France 55,029.
Unspecified and mixed	39,208	43,961	7	Belgium-Luxembourg 25,451; West Germany 11,736; Sweden 3,873.
Graphite, natural	495	8,211	--	Sweden 4,823; United Kingdom 2,964; West Germany 342.
Gypsum and plaster	209,567	211,318	--	Spain 116,474; France 43,298; East Germany 28,552.
Lime	41,071	33,750	(2)	Denmark 25,073; Sweden 7,494; United Kingdom 638.
Magnesium compounds	7,947	6,911	2	China 3,108; Austria 2,007; North Korea 551.
Mica:				
Crude including splittings and waste	4,044	1,284	57	India 1,087; Netherlands 102.
Worked including agglomerated splittings	63	63	(2)	Switzerland 37; United Kingdom 11; Belgium-Luxembourg 8.
Nitrates, crude	83	156	--	All from West Germany.
Phosphates, crude	452,112	445,807	25,584	Sweden 165,253; Togo 90,088; Morocco 81,487.
Pigments, mineral: Iron oxides and hydroxides, processed	2,726	2,450	--	West Germany 2,291; Spain 105; Netherlands 41.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$2,870	$431	$14	West Germany $135; United Kingdom $81; Belgium-Luxembourg $38.
Synthetic do.	$270	$36	$4	Switzerland $10; West Germany $7; United Kingdom $5.
Pyrite, unroasted	--	3,948	--	All from Finland.
Salt and brine	561,314	555,603	4	Netherlands 336,363; United Kingdom 59,766; Spain 55,488.
Sodium compounds, n.e.s.: Carbonate, manufactured	49,982	48,869	--	Poland 15,454; Netherlands 14,440; West Germany 12,686.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	9,726	10,149	3	Sweden 4,168; Italy 2,098; Finland 1,175.
Worked	17,738	23,544	(2)	Portugal 13,540; Sweden 5,887; Italy 1,689.
Dolomite, chiefly refractory-grade	11,342	8,211	--	Sweden 4,823; United Kingdom 2,964; West Germany 342.
Gravel and crushed rock	109,711	63,225	11	Sweden 61,383; Italy 716; Denmark 686.
Limestone other than dimension	244,954	216,133	--	United Kingdom 189,256; Denmark 14,160; France 7,607.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel —Continued				
Quartz and quartzite	655,831	589,369	(2)	Sweden 329,665; Spain 244,732; Canada 11,869.
Sand other than metal-bearing	242,166	209,636	398	Belgium-Luxembourg 129,601; Sweden 54,218; United Kingdom 4,045.
Sulfur:				
Elemental:				
Crude including native and by-product	4,117	6,138	--	Sweden 5,697; West Germany 380; Belgium-Luxembourg 60.
Colloidal, precipitated, sublimed	61	11	--	West Germany 10; United Kingdom 1.
Sulfuric acid	120	1,937	(2)	France 1,731; Denmark 103; Sweden 49.
Talc, steatite, soapstone, pyrophyllite	8,046	6,302	30	Finland 2,061; China 236; Austria 221.
Other:				
Crude	85,086	71,084	(2)	West Germany 46,172; East Germany 10,903; Sweden 7,277.
Slag and dross, not metal-bearing	160,363	164,431	--	Denmark 131,638; Sweden 21,362; Netherlands 9,022.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	234	58	58	
Carbon black	5,532	5,857	64	Sweden 3,134; Netherlands 1,115; United Kingdom 983.
Coal:				
Anthracite and bituminous	913,054	769,563	232,923	Australia 88,715; West Germany 78,623.
Briquets of anthracite and bituminous coal	730	2,000	--	Belgium-Luxembourg 1,050; Netherlands 950.
Lignite including briquets	3,639	11	--	All from West Germany.
Coke and semicoke	700,176	600,709	23,150	United Kingdom 297,352; France 75,705; East Germany 54,621.
Peat including briquets and litter	17,949	20,710	--	Sweden 18,667; West Germany 1,355; Finland 577.
Petroleum:				
Crude thousand 42-gallon barrels	11,000	14,794	--	United Kingdom 11,061; Saudi Arabia 1,945; U.S.S.R. 1,457.
Refinery products:				
Liquefied petroleum gas[4] do	1,612	2,726	--	United Kingdom 2,459; U.S.S.R. 151.
Gasoline do	4,820	6,678	27	Sweden 2,742; Netherlands 1,927; United Kingdom 701.
Mineral jelly and wax do	77	73	(2)	West Germany 50; China 9; United Kingdom 9.
Kerosene and jet fuel do	1,031	2,345	26	United Kingdom 810; Netherlands 502; Libya 356.
Distillate fuel oil do	6,037	8,600	109	East Germany 2,218; Sweden 1,971; United Kingdom 1,205.
Lubricants do	746	683	10	Sweden 303; United Kingdom 202; Belgium-Luxembourg 58.
Residual fuel oil do	4,816	5,356	--	East Germany 1,661; U.S.S.R. 1,382; Sweden 1,362.
Bitumen and other residues do	1,197	1,323	(2)	Sweden 853; Netherlands 280; Belgium-Luxembourg 82.
Bituminous mixtures do	111	132	1	Sweden 101; Netherlands 24; Denmark 2.
Petroleum coke do	2,100	2,007	1,647	United Kingdom 192; Netherlands 115.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.
[4]International Energy Agency.

COMMODITY REVIEW

METALS

Aluminum.—Hydro Aluminium A/S, the largest producer of primary aluminum in Western Europe, increased its share in Sör-Norge Aluminium A/S (Soral) to 50% by purchasing shares from the other owner, Swiss Aluminium Ltd. (Alusuisse). Soral operated a 66,000-ton-per-year primary aluminum plant at Husnes in Norway. Hydro's total annual primary aluminum capacity in Norway was 620,000 tons. A little over 600,000 tons was produced in 1987, a 10% increase. The company was 70%-owned by Norsk Hydro A/S, which had an option to buy the Government's 30% share. Hoyanger Verk, the smallest of Hydro's four 100%-owned aluminum smelters, operated at a loss, but the other three were profitable.

Mosal Aluminium A/S, 55%-owned by Elkem A/S and 45%-owned by the Aluminum Co. of America, produced 164,000 tons of primary aluminum at its two Norwegian smelters. The Lista smelter, one of the two, produced a record high 80,000 tons.

Copper.—The Lokken Gruber A/S copper-zinc mine southwest of Trondheim was closed at midyear because of reserves depletion after having been operational for more than 3 centuries. The mine, jointly owned by Orkla-Borregard A/S and Finland's Outokumpu Oy, was one of Norway's four largest copper mines that together had produced about 90% of Norway's copper concentrate. A fifth mine, Outokumpu's Bidjovagge Gruber A/S, had been reopened in 1985 after having been idle for 10 years. It was meant to supply concentrate to Outokumpu's Harjavalta smelter in Finland. Production from this mine reached 3,200 tons of copper in concentrate during 1987. One lead-zinc mine and an iron mine each produced minor amounts of byproduct copper concentrate. A/S Sydvaranger closed its small A/S Killingdal Grubeselskab copper-zinc mine and flotation plant at Trondheim early in the year.

In May, Orkla-Borregard and Outokumpu formed a joint venture, Norsulfid A/S, which owned and operated Folldal Verk A/S and 51% of Grong Gruber A/S, two of the three largest remaining copper mines. Both produced byproduct zinc concentrate. Folldal Verk was also a major producer of pyrite. It was intended to transfer Orkla-Borregard's shares to Outokumpu by year-end 1988, at which time Orkla-Borregard would no longer be in mining.

Ferroalloys.—The Norwegian ferroalloy industry maintained its production level and West European market position despite world market low prices and increased production from developing countries, particularly Brazil. Ferroalloy price recoveries during the second half came too late to prevent industry from suffering a significant financial loss during 1987. Dumping was alleged of producers other than Norway of ferrosilicon into the European Economic Community (EEC) market at prices 10% below those prevailing.

Manganese ore was excluded for at least 2 years from sanctions legislated by the Norwegian Government effective July 20 against trade with the Republic of South Africa. Approximately 40% of ferroalloy industry needs for this ore had been supplied by this source, mostly for use at the Porsgrunn and Sauda ferromanganese smelters. About one-third of manganese ore imports was from Gabon, where the Norwegian ferroalloy industry owned part of the manganese-mining industry.

Gallium.—Elkem began preliminary operation of Norway's first gallium metal recovery plant. The $2 million plant, with a capacity of 5,000 kilograms per year, was constructed on the site of Elkem's Bremanger ferrosilicon smelter. Nearly all of the 99.99%-pure metal was scheduled for export primarily for manufacture of gallium arsenide for use in semiconductors.

Gold.—Significant quantities of gold were found by Outokumpu in its recently reopened Biddjovagge copper mine in northern Norway. Subsequently, only those seams were mined that were rich in gold, 1 to 4 grams per ton, as well as rich in copper, 1% to 2%. Concentration of the ore produced about 30,000 troy ounces of gold and 3,200 tons of copper during 1987. The concentrate was shipped by truck and rail to Outokumpu's Harjavalta smelter in Finland. The former byproduct gold had become significantly more valuable than the copper in the Biddjovagge Mine. Reserves were sufficient for only 1 or 2 years of operation. No significant amounts of gold had been mined in Norway during the previous few decades.

Iron Ore.—State-owned A/S Sydvaranger ceased mining its Tverrdalen deposit be-

cause the deposit contained the leanest ores and had the highest production costs of any of its iron mines. The company continued to operate at a loss, requiring an annual Government subsidy of about $30 million. Three iron ore deposits were being mined at yearend. These were Bjornevatn North, Bjornevatn East, and Jerntoppen, which was opened in 1987. Total production of iron ore concentrate by Sydvaranger decreased by 20% to 1.45 million tons. Nearly 50% of the concentrate came from Bjornevatn North. The concentrate was pelletized, and more than 95% of the high-silica (acid) pellets was shipped overseas, primarily to the United Kingdom, 74%, and to the Federal Republic of Germany, 25%.

State-owned Norsk Jernverk A/S, the other large iron ore producer, decreased its production rate in August by 35% to 1.0 million tons of iron ore per year because of low product prices. Employees in the Mining Division in the Mo i Rana area were reduced by 20% to 325. Total concentrate production decreased by 10% to 1.29 million tons. Of this, 41% was consumed by the company in its production of pig iron, compared with 61% in 1986. The balance was exported. An underwater landslide in February closed the company's new shipping terminal on the west coast, requiring alternative shipping arrangements. Norsk Jernverk, Norway's only primary steel producer, received no Government subsidies during 1987, although it operated at a loss. Continuance of the company's mining activity, which was only about 10% of the company's total activity, remained in doubt as talks with the Government continued regarding its mining future.

Iron and Steel.—Norsk Jernverk closed two of its six pig iron furnaces at its Mo i Rana complex, thereby reducing Norway's iron production capacity by one-third. The company's two LD steel oxygen converters at the complex then used more scrap iron feed to compensate for the lost pig iron. A newly commissioned steel arc furnace at the complex reached full capacity by yearend. Approximately 80% of the company's crude steel was made at Mo i Rana and about 80% of that was used as feedstock for its rolling mills. The remainder of the crude steel was made in an arc furnace at the Nydalen works at Oslo. About 60% of Norsk Jernverk's rolling capacity was at Mo i Rana, 25% was at Nydalen, and the remainder was at a tinplate plant at Bergen. The company concentrated during the year on markets in the Nordic area, the EEC and the United States. The offshore oil market for steel was down although the market for reinforcing steel bars remained steady. Productivity was up on a ton-per-wage-krona basis. However, a consulting firm was contracted to present rationalization options to enable the company to return to a position of profit. Construction was completed of a pilot plant for development of a new steelmaking (direct reduction) process in partnership with Elkem.

Lead.—A/S Bleikvassli Gruber's zinc-lead mine remained the only lead concentrate producer in Norway after closure at midyear of the Bergverkselskapet Nord-Norge A/S zinc mine, which had produced minor amounts of byproduct lead. Both companies were subsidiaries of Sydvaranger.

Magnesium.—Construction of Norsk Hydro's 60,000-ton-per-year magnesium plant in Bécancour, Quebec, Canada, began in the spring. Startup was still scheduled for spring 1989 and full capacity was expected to be reached by 1990 or 1991. The major end user was expected to be the U.S. automotive industry, but a substantial portion was targeted for the overseas market, particularly Japan.

Nickel.—A major expansion at Falconbridge Nikkelverk's A/S refinery at Kristiansand was completed during the year. Capacity was increased by 33% in order to process annually 54,400 tons of nickel matte delivered under a long-term contract with BCL Ltd. of Botswana. Production of electrolytic nickel during 1987 increased by 17% to a record high despite a 1-month scheduled production shutdown caused by low prices and a world oversupply.

Scandium.—Elkem, along with Mitsubishi Corp. of Japan, assumed controlling interest in A/S Megon, a producer of yttrium oxide for use in laser crystals and other "high-tech" applications at a plant near Oslo. Megon was engaged in the development of technologies for extracting and purifying rare-earth oxides including scandium oxide, a valuable material used in superconductors, collimators for neutron lenses, high-powered lights, and semiconductors. A pilot plant was reported to have become operational during 1987 producing 99.999%-purity scandium oxide. Eventual capacity of the plant was to be 10 kilograms per year. Elkem was exploring in Norway for scandium-bearing deposits.

Folldal Verk A/S acquired mining rights

to a large, unique rock deposit in the Kautokeno greenstone belt in Finnmark in Arctic Norway. It contained mostly albite, but also the rare titanium mineral davidite, which contained inclusions of thortveitite, which in turn contained scandium. Further evaluation of the deposit, estimated to contain up to 5,000 kilograms of scandium, was underway. The deposit had been first discovered in 1983 by the Norwegian Geological Survey using airborne geophysical methods.

Vesteralen Mining Industries, a new venture company, announced plans to mine a scandium-bearing titaniferous magnetite deposit in the Vesteralen region of Arctic Norway. Plant construction was to begin in mid-1988 with production startup in mid-1989. The deposit appeared to be much larger than the more northerly Finnmark deposit. Prefeasibility studies were in progress and financing through sale of stock and/or mining partners was being sought.

Silicon.—Oversupply of silicon in the world market, caused mainly by increased production capacity in Brazil and the emergence into the world market of inexpensive low grades from China, caused Tinfoss Jernverk A/S to close permanently its only silicon plant, at Notodden, at the beginning of the year. This oversupply also caused Elkem to close one-half of its 33,000-ton-per-year Meraker plant in the fall and to reduce staff accordingly. Norway's major markets, Western Europe and Japan, were very depressed during the first half of the year. They did not fully recover during the second half despite increases in aluminum production, the major end use of silicon. Specialty grades for the electronics industry were produced at Elkem's Bremanger plant, mainly for Japan. Total Norwegian annual capacity at yearend was about 100,000 tons. Operating problems halted production at some plants for short periods. Elkem's United States and Canadian silicon operations stepped up in response to increased aluminum production in North America. The North America silicon plants had been rationalized extensively over the previous few years.

Zinc.—One zinc mine, Sydvaranger's Bergverkselskapet Nord-Norge, and the Lokken Gruber Mine with copper and zinc coproducts closed as scheduled at midyear. The closings lowered Norway's zinc-mining capacity by about 7,000 tons per year of zinc in concentrate and decreased 1987 production by 19%. Two zinc mines and a copper mine with zinc byproduct remained with a combined annual capacity of a little under 20,000 tons of zinc in concentrate.

Norzink A/S produced 29% more zinc metal, all at its Eitrheim smelter, although production was 7% below the targeted output because of startup problems in the new cellhouse as well as foundry difficulties. The smelter complex operated at a loss because of high production costs and low product prices, which began to increase during the final quarter.

INDUSTRIAL MINERALS

Fertilizer Materials.—Norsk Hydro put its new complex-fertilizer plant on-stream at Porsgrunn during the year. Some temporary stoppages were incurred subsequently by operational failures. A new calcium nitrate plant also came on-stream at Porsgrunn.

Norsk Hydro, the world's largest fertilizer producer, purchased the remaining 20% of Cie. Française de l'Azote et Produits Chimiques S.A. (COFAZ), France's largest fertilizer producer, near yearend, thereby acquiring full ownership of the firm. The company continued to invest in new facilities, some of which came on-stream during 1987, and it closed outdated units at its plants in Western Europe. Ammonia capacity was fully utilized and urea capacity less so. Fertilizer prices did not rise sufficiently, after their sharp fall in 1986, to ensure adequate profitability for the Agricultural Group during 1987, but earnings were improved.

Graphite.—A/S Skaland Grafitverk was purchased by its West German competitor Graphitverk Kropfmuhl AG. A new 10,000-ton-per-year graphite-flake concentrator was under construction and was expected to be completed by early 1989. A 2-year exploration program, since the 1985 concentrator fire, had revealed reserves in quantity sufficient for 25 years of operation.

Mica.—Flake mica continued to be produced by Norfloat A/S at Glamsland near Lillesand as a byproduct of feldspar and quartz production through beneficiation of quarried pegmatite.

Quartz.—Technical startup problems prevented Minnor K/S, owned equally by Elkem and A/S Aker-Norcem, from putting its production plant for high-purity quartz on-stream as scheduled. Market introduction was delayed because the required high purity of product was not achieved despite intensive efforts.

Titania.—Problems in the operation of new equipment in the TiO_2-slag plant at Tyssedal prevented attainment of more than 20% production capacity and created a debt of $90 million after 1 year of operation. Failure to procure even short-term funding caused the Government-owned company's board to close the plant in late November. Financial support was still being sought at yearend for continuance of plant operation.

MINERAL FUELS

Coal.—Government-owned Store Norsk Spitsbergen Kulkompani A/S continued mining subbituminous coal with Government subsidies on Spitsbergen, the largest island in the Svalbard archipelago above the Arctic Circle, as it had for 70 years. Recent annual production had been 400,000 to 500,000 tons. Two longwall mines were operating in permafrost at Longyearbyen, and a third mine, a room-and-pillar operation, continued to be developed in Svea 40 miles southeast of Longyearbyen. Productivity at Longyearbyen had increased by 50% since 1982 to 7 tons per worker-shift. Reserves, mostly at Svea, were approximately 27 million tons. About 100,000 tons per year was exported to the Federal Republic of Germany for use in powerplants especially equipped to handle Spitsbergen coal. About 200,000 tons per year went to the state-owned coking plant in Mo i Rana, and the remainder was consumed in the Norwegian ferroalloy and cement industries.

Several years of exploration by a private Finnish-Norwegian consortium had revealed the existence of about 300 million tons of coal at Gipsdalen north of Longyearbyen. The consortium estimated that higher coal prices and an annual output of at least 1 million tons would be required in order to make a mining venture at Gipsdalen viable.

Natural Gas.—Approximately 43% of Norway's natural gas sales were from gasfields in Norway's portion of the Frigg area of the North Sea. The other sources were gas coproduct with oil from the Ekofisk area, 27%; the Heimdal Gasfield, 14%; byproduct gas from Norway's portion of the Statfjord Oilfield, 12%; and byproduct gas from the Valhall Oilfield and the new Ula Oilfield, most of the remainder. About 40% of gas production from the Statfjord Field continued to be reinjected to improve oil recovery. Natural gas sales, all exported, increased significantly in 1987 to meet export commitments, and output increased from Ekofisk, Heimdal, and Statfjord.

Proven reserves of natural gas in fields either producing or approved for development was sufficient for about 35 years at the 1987 gross output rate. An additional 45 years of resources was available in the North Sea and in the Haltenbanken and Troms-Finnmark areas of the more northerly Norwegian Sea.

The Frigg area consisted of the large Frigg Gasfield, which was jointly owned by Norway and the United Kingdom, and two smaller operating fields, North East Frigg and Odin. Gas from all three fields was processed and metered at the Frigg platform complex and then piped to St. Fergus in Scotland. East Frigg, another field within the area, scheduled to go on-stream in 1988, was also to feed into the Frigg Complex. Elf Aquitaine Norge A/S was the operator of all of the Frigg area fields. New reserve estimates made in 1987 indicated that gas in the Frigg area would be exhausted by yearend 1990, about 5 years sooner than previously expected, thereby reducing Norway's output and the United Kingdom's supply.

Development of the Den Norske State Oljeselskap A/S (Statoil) Tommelitin Gasfield began in 1987 and production was scheduled to begin in October 1988. The gas was to be piped to the Edda Field within the Ekofisk area. The intention was to inject this gas into the Ekofisk Field until 1991, after which it was to be piped to Karsto on the mainland for use in a to-be-constructed gas-fired electrical power station.

Engineering design of the platforms for the very large gasfields, Sleipner and Troll, began in 1987, mostly by Aker Engineering A/S. Troll was to have the largest platform in the North Sea. A/S Norske Shell was allowed by the Government to be Troll's operator until production was to begin in 1996, after which Statoil would become the operator. Statoil was already the operator of Sleipner, which was scheduled to begin production in 1993. After having decided to transport most of its Sleipner-Troll gas to Western Europe via Zeepipe through Belgium, Statoil was considering, as an alternative, use of the Netherlands North Sea gas-transmission system. Statoil anticipated future lower gas production by the Netherlands because of its depleting North Sea reserves.

One gasfield in the North Sea, 30/6 Gamma North, was declared to be commercial by its operator. The gas was to be used for injection into the Oseberg North Oilfield, which was under development. Estimated

gas reserves in Gamma North were 260 billion cubic feet.

Significant quantities of gas were found in the Hammerfest Basin in the Troms I sector of the Arctic offshore Tromsoflaket area north of Troms.

Petroleum.—Norwegian production of crude petroleum, all from the North Sea, increased for the sixth consecutive year. Statoil's large Statfjord Field, which was shared with the United Kingdom, continued to be the largest producer. The Norwegian portion of its output accounted for 60% of Norway's crude production in 1987. The Ekofisk area, operated by Phillips Petroleum Co. Norway A/S, produced 18% of Norway's crude from seven fields—Ekofisk, Eldfisk, Albuskjell, West Ekofisk, Cod, Edda, and Tor, in approximate order of size. The decks on five of the platforms in the central Ekofisk complex were raised simultaneously in August by 20 feet. This significant engineering feat was necessary because further subsidence of the seabed would have submerged critical operations. Production of crude from the field during 1987 decreased as predicted by the 1-month closedown. Future production in Ekofisk area fields was to be augmented by injection of water and nitrogen. About 9% of the natural gas coproduct was reinjected during 1987, less than during the previous year. The remainder of Norway's crude oil production was from the Ula Field, 8%; the Gullfaks Field, 7%; the Valhall Field, 6%; and the Murchison Field, 1%. Oil production from the new Ula and Gullfaks Fields accounted for most of the increased production in 1987. Gullfak's platform B, a drilling and water-injection unit, was placed in the field and was expected to be operating by early 1988, ahead of schedule. Platform C, the second Gullfaks production unit, was expected to be constructed by early 1988 on schedule with planned startup in 1989. Platform A began producing in late December 1986.

Income from the sale of Norwegian crude oil and natural gas had peaked in 1985 and equaled 19% of GNP. This dropped to 11% in 1986 and partially recovered to 12% ($10 billion) in 1987. Total 1987 investment in petroleum production and pipeline systems, excluding exploration, was $4 billion.

The Norwegian Government reduced Norway's production of crude by 8% below capacity, on a daily basis, during 1987. This step came in response to OPEC's call for production restraints as an aid in preventing world oil prices from dropping. This policy was not welcomed by the field operators, particularly at the partially United Kingdom-owned Statfjord Field. The Government modified its across-the-board-reduction position for the last quarter of 1987, allowing Gullfaks to assume Statfjord's 8% cut during that period.

Proven reserves of crude petroleum in fields either producing or approved for development decreased for the first time but were sufficient for 17 years of production at the 1987 output rate. Four fields provided 83% of this reserve. These were Oseberg, Statfjord, Gullfaks, and Ekofisk, in order of reserve volume. Oseberg, which was under development, was estimated to contain 25% of Norway's proven reserves. Other estimated crude oil resources in the North Sea were sufficient for an additional 9 years of production. The Smorre Field contained about 20% of this oil. Similar estimated resources in Haltenbanken in the Norwegian Sea were sufficient for an additional 5 years of production. The Heidrun Field contained nearly one-half of this and the Draugen Field nearly one-quarter.

Two North Sea oilfields received development approval from the Government in June 1987. The Veslefrikk Field to be operated by Statoil was scheduled to go on-stream in September 1989. A floating production platform was to be connected to a fixed wellhead platform. The oil was to be piped to the Oseberg platform and by-product gas was to be landed in Norway through the Statpipe system. The Gyda Field, to be operated by BP, was scheduled to go on-stream in September 1990 with water injection. The oil was to be piped to Ekofisk via the Ula Field. The coproduct gas was to be carried in a new pipeline directly to Ekofisk and used there. Total annual crude output from these two developing fields, which are about equal in size, was expected to equal 14% of 1987 production. Proven reserves were sufficient for about 1 decade of operation. Estimated development costs for the two fields totaled $2 billion.

Development of the southern portion of Statoil's large Oseberg Field continued. Construction of platforms A and B continued on schedule in conformity with the April 1989 startup date. Water injection was to be supplemented by injection of gas from the Troll Field beginning in 1992. Total oil production expectancy was 15 years. The crude was to be delivered to a new storage and loading platform at Sture

about 40 miles north of Bergen through a 68-mile pipeline constructed in 1987 as the first oil pipeline from the North Sea to mainland Norway. Total annual output was expected to equal 25% of 1987 crude oil production. Gas production was scheduled to begin after oil production was terminated. It was expected that most of the injected gas then would be recovered.

Development plans for five new oilfields were submitted for Government approval during the year by their operators. These were, in order of estimated oil reserves, the Snorre Field near Statfjord, operated by Saga Petroleum A/S; the Heidrun Field, with natural gas coproduct, in the Haltenbanken area of the Norwegian Sea north of Trondheim, operated by Norske Conoco A/S; the Draugen Field in the Haltenbanken area, operated by Norske Shell; the Oseberg North Field, operated by Norsk Hydro; and the Brage Field near Oseberg, operated by Norsk Hydro. Total estimated crude oil reserves of the five fields was 2.5 billion barrels and total expected annual production was 120 million barrels, equivalent to 35% of Norway's 1987 production. The operators projected that the fields could be variously on-stream between 1990 and 1992, assuming immediate approval, at an estimated total development cost of $11 billion. Industry sources forecast profitable operations at $15 to $18 per barrel through development of engineering efficiencies and economies. North Sea oil fluctuated between $17 and $20 during 1987. In view of the increase in field development applications, the Government prepared a report by yearend that called for limiting and prioritizing potential developments. A Parliamentary vote was expected during 1988.

Oilfield development in the Haltenbanken area was expected to be technologically difficult and costly and dependent on future markets for natural gas. Also, the area had no infrastructure. The fields were in deep water with a rugged sea floor. It was likely that the initial oil production would be transported by tankers.

Thirty-six exploratory wells were drilled in offshore Norway during 1987, the same as in 1986. Of these, 25 were initial exploratory (wildcats) and 11 were appraisal wells. Also, 17 were in the North Sea, 14 were off mid-Norway, including the Haltenbanken area, and 5 were in the Barents Sea. One U.S. operator, Mobil Development Norway A/S, made a significant gas-condensate discovery. Nine other wells tested positive. Of these, the most promising finds were oil near the Frigg and Heimdal Fields by Elf Aquitaine and oil near Statfjord and Gullfaks by Saga. All five wells drilled in the Barents Sea were dry except for a small gas find. This represented the first exploratory drilling in the Barents Sea. Some limited onland exploratory activity on Svalbard gave no significant findings.

In May, 13 exploratory licenses were granted—7 in the Barents Sea, 4 in Haltenbanken, 1 in the North Sea, and 1 in More South. Six U.S. oil companies participated as part owners of these licenses, and two, Conoco and Mobil, were operators.

The 12th exploratory round was announced in August, and the applications deadline was February 19, 1988. All of the blocks offered were in the North Sea near existing large producing or developing wells where prospects were good. Most were in the Ekofisk area near the United Kingdom North Sea border, the Statfjord area near both the Danish and the United Kingdom North Seas, and Sleipner. Awards were to be made during the summer of 1988.

Government-owned Statoil began an upgrading and a 63% expansion of its large Mongstad oil refinery and storage facility north of Bergen to 134,000 barrels per day. The construction, which included a new 40,000-barrel-per-day catalytic cracker, was about 60% completed by yearend and was scheduled for completion by yearend 1988. The minor partner in the venture, Norsk Hydro, sold its 30% share to Statoil in September for $91 million. It was apparent to Norway's Department of Energy by late summer that the cost of the expansion could be as high as $2 billion, about double that of the original estimate. Apparently, the complexity of the modification had been underestimated by Statoil. The Department appointed new directors to Statoil's board by yearend.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values were converted from Norwegian kroner (NKr) to U.S. dollars at the rate of NKr6.74=US$1.00, the average for 1987.

The Mineral Industry of Pakistan

By Charles L. Kimbell[1]

The year 1987 was one of growth for major components of Pakistan's modest mineral industry. The gain in crude oil production, miniscule in comparison to those of the past 3 years, was disappointing in that it contributed little to the country's drive for energy materials self-sufficiency. However, a 20% gain in coal production and a 4.7% growth in natural gas production were noteworthy improvements in Pakistan's efforts to reduce its dependency on imported energy materials.

International problems beyond the borders of Pakistan had a demonstrable impact on civil order within Pakistan, and hence on industrial activity, including that of the mineral industry. The Iran-Iraq war spilled over well beyond the Persian Gulf into the streets of Karachi, Pakistan's most populous city and the center of its industrial activity, with shootouts between pro- and anti-Khomeni factions of sufficient magnitude to disrupt the travel of workers to and from their jobs. These firefights, coupled with other breakdowns in civil order that apparently were of an internal nature, were described in local press accounts as having a measurable effect on industrial activity. On several occasions, a significant part of the work force simply stayed home to avoid being killed. Similarly, air raids by the Soviet-backed military forces of Afghanistan, directed at those areas of Pakistan near the Afghan border where an estimated 3 million displaced Afghans are housed in refugee camps, certainly contributed to a climate far less than ideal for industrial growth and development.

On a more positive note, it was reported that the Geological Survey of Pakistan earmarked about $8.4 million[2] for implementation of a mineral exploration and deposit evaluation program in Baluchistan Province.

PRODUCTION

In broad perspective, Pakistan's mineral industry upped its output in 1987 relative to 1986 performance. Gains by such operations as the country's single integrated steel plant, the majority of its cement plants, the fertilizer industry, and all three major components of the country's fuel industry (coal, natural gas, and petroleum), more than balanced shortfalls by some of the other components of the industry.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum: Bauxite, gross weight	3,161	2,720	1,759	2,881	3,447
Antimony ore:					
Gross weight	--	6	24	--	45
Sb content[e]	--	1	4	--	7
Chromium: Chromite:					
Gross weight	5,959	2,997	5,188	8,299	9,963
Cr content[e]	1,966	989	1,712	2,739	3,288
Iron and steel:					
Pig iron[e] thousand tons	472	566	803	892	903
Steel, crude[e] do.	550	610	700	800	910
Lead, refined, secondary[e]	1,000	1,000	1,000	1,000	2,000
Manganese ore:					
Gross weight	--	8	135	635	--
Mn content[e]	--	2	41	r190	--
INDUSTRIAL MINERALS					
Abrasives, natural: Emery	1,689	1,393	4,630	4,972	3,060
Barite	26,018	27,230	29,932	39,047	10,031
Cement, hydraulic[2] thousand tons	4,938	4,697	r e5,229	r e6,130	6,832
Chalk	2,217	1,360	2,082	2,192	4,292
Clays:					
Bentonite	667	1,740	1,611	1,282	2,537
Fire clay	87,740	79,528	68,537	87,522	122,513
Fuller's earth	21,136	19,139	10,647	15,228	18,045
Kaolin (china clay)	12,834	11,711	6,644	37,056	32,208
Other	87,000	130,000	285,000	520,000	395,000
Feldspar	5,280	5,468	5,633	11,575	6,675
Fluorspar	336	2,724	3,175	4,353	3,673
Gypsum, crude	318,000	375,000	409,000	373,000	448,000
Magnesite, crude	1,998	4,153	2,113	1,757	3,740
Nitrogen: N content of ammonia	1,098,400	1,127,700	1,106,800	1,154,400	1,179,000
Phosphate rock	--	--	--	50,000	32,000
P_2O_5	--	--	--	16,000	10,000
Pigments, mineral, natural: Ocher	1,077	1,046	553	608	1,792
Salt:					
Rock thousand tons	571	598	583	576	485
Marine do.	e189	e180	269	242	308
Total do.	e760	e778	852	818	793
Sand and gravel:					
Gravel	234,000	74,000	16,000	--	11,000
Sand:					
Bajri and common	e131,000	294,397	352,496	136,964	208,339
Glass	90,000	100,000	202,000	115,000	149,000
Sodium compounds, n.e.s.:					
Caustic soda[3]	40,096	r e40,600	r e52,300	r e54,000	56,571
Soda ash, manufactured	102,000	e121,000	118,087	130,894	133,133
Stone:					
Aragonite and marble	116,000	80,000	62,000	168,000	229,000
Dolomite	92,874	121,750	121,578	136,271	141,856
Limestone thousand tons	4,194	5,184	6,685	6,339	7,279
Other (reported as "ordinary stone") do.	e385	525	366	677	571
Strontium minerals: Celestite	135	564	718	997	1,083
Sulfur:					
Native	628	926	877	890	1,120
Byproduct, all sources[e]	25,700	26,000	26,000	r26,000	26,000
Total[e]	26,328	26,926	26,877	r26,890	27,120
Talc and related materials: Soapstone	15,956	15,568	20,183	23,021	32,905
MINERAL FUELS AND RELATED MATERIALS					
Coal, all grades thousand tons	1,859	2,134	2,199	2,025	2,444
Coke do.	e345	e533	556	630	633
Gas, natural:					
Gross production million cubic feet	343,504	352,933	366,282	392,485	410,849
Marketed production (sales) do.	328,000	331,108	345,000	r e370,000	388,000
Natural gas liquids[e] thousand 42-gallon barrels	45	45	55	r65	70
Petroleum:					
Crude do.	4,954	6,534	12,522	15,065	15,230
Refinery products:[3]					
Gasoline do.	r4,845	r5,457	5,738	5,865	7,012
Jet fuel do.	r3,744	r3,792	3,712	3,944	3,712
Kerosene do.	r1,860	r2,000	2,379	3,209	3,015
Distillate fuel oil do.	10,010	r10,004	11,473	13,152	13,040
Residual fuel oil do.	9,718	r10,216	10,250	11,382	11,635

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum: —Continued					
Refinery products:[3] —Continued					
Lubricants thousand 42-gallon barrels	721	r742	875	980	1,005
Other do	3,083	r2,592	3,217	3,526	3,615
Total do	33,981	34,803	37,644	42,058	43,034

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

[1]Table includes data available through Aug. 10, 1988.

[2]Pakistan's official reporting is on the basis of fiscal years beginning July 1, of each year; the Pakistan Federal Bureau of Statistics revised cement figures upward for the years beginning July 1, 1984, July 1, 1985, and July 1, 1986, but did not provide revised monthly figures for the first 2 years. Hence the undistributed additions to production fiscal years have been apportioned calendar years. For this reason, the results for calendar years 1985 to the appropriate and 1986 have been classified as estimates. Similar revision in officially reported production data necessitated revisions of calendar year data to an estimated basis for 1984, 1985, and 1986.

[3]Refinery fuel is not reported separately; presumably it is included in the quantities reported for the various fuel types, chiefly residual fuel oil.

TRADE

In 1986, the most recent year for which comprehensive trade data are available, Pakistan recorded a net commodity trade deficit of $1,993 million, $1,159 million less than its 1985 total commodity trade deficit of $3,152 million. Corresponding trade-deficit figures for mineral commodities alone were $1,150 million in 1986 and $1,846 million in 1985, for a deficit reduction of $696 million. Reduction in the net outflow of funds both for total trade and mineral commodities were to a significant extent the result of a reduction in the value of mineral fuel imports, although there were declines in the values of imports for several other commodity groups as well.

Among mineral commodity imports, fuels remained dominant, at $765 million, accounting for over 58% of the total in 1986, but this compared with $1,433 million in 1985, which approached 74% of the total. The next most significant mineral commodity import groups were iron and steel, valued at nearly $207 million in 1986, slightly below the 1985 level of $213 million; and manufactured fertilizers, valued at almost $150 million in 1986, almost 37% above their 1985 level of $109 million.

Among mineral commodity exports and reexports, manufactured fertilizers were the largest major group in 1986, accounting for almost 51% of the total and substantially ahead of mineral fuels (chiefly refinery products), which accounted for almost 24%, and iron and steel with 12%. This represented a significant shift from the pattern in 1985 when iron and steel ranked first with 30%, fuels ranked second with 23%, and manufactured fertilizer ranked third with 19% of the total.

The following tabulation summarizes the value of mineral commodity trade for 1985 and 1986, and provides data on the value of total commodity trade for comparison in million U.S. dollars:

	1985	1986
Mineral commodities:		
Exports	r$101.6	$161.9
Reexports	r.4	.4
Total	r102.0	162.2
Imports	1,948.4	2,311.8
All commodities:		
Exports	2,707.6	3,302.9
Reexports	31.1	81.1
Total	2,738.7	3,384.0
Imports	5,890.4	5,376.8

[r]Revised.

In 1986, 8% of Pakistan's mineral commodity exports and reexports by value went to developed market economy countries, 59% to developing market economy countries, and 33% to centrally planned economy countries. Corresponding 1985 export figures were 28%, 62%, and 10%. These results may be compared with the distribution of total export trade for 1986, as follows (1985 results in parentheses): developed

market economy countries, 56% (50%); developing market economy countries, 40% (42%); and centrally planned economy countries, 4% (8%). On the import side of mineral trade, 38% of the total value came from developed market economy countries, 60% from developing market economy countries, and only 2% from centrally planned economy countries; 1985 figures were 23%, 75%, and 2%, respectively. For comparison, 1986 results for total import trade (1985 results in parentheses) were as follows: developed market economy countries, 64% (55%); developing market economy countries, 31% (41%); developing market economy countries, 64% (55%); and centrally planned economy countries, 5% (4%). The sharp changes, both in mineral commodities and total commodities, away from developing market economy countries in favor of the other areas chiefly were the result of the drop in mineral-fuel-import values from the developing nations.

Pakistan's trade with the United States has been less significant in terms of mineral commodities than in terms of total trade. Among exports and reexports, the U.S. share of total commodity trade was 11% in 1986, up 1% over the 1985 level, but in both years, the U.S. share of total mineral-commodity exports was less than 1%. The United States provided 13% of Pakistan's total commodity imports in 1986, 1% below the 1985 level. Among mineral commodities, the United States acccounted for 11% of the 1986 value, a notable increase over the 6% level of 1985. This was primarily the result of an increase of nearly $43 million to $116 million, in the value of manufactured fertilizer imports from the United States.

In the 1985 edition of this chapter, it was reported that Pakistani authorities had indicated that rising internal demand for fertilizer in 1986 consumed much of the production that had been an exportable surplus in 1985; however, published trade results showed a $64 million upturn in manufactured fertilizer export values in1986, although the value of imports of these materials also increased significantly. Manufactured fertilizer exports grew from $19 million to $83 million, while imports increased from $109 million to $150 million.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Scrap	61	15	--	All to Japan.
Unwrought	2	--		
Chromium: Ore and concentrate	10,264	31,223	--	China 25,598; Sweden 5,625.
Copper: Metal including alloys:				
Scrap	8,607	810	--	Japan 532; United Kingdom 171.
Semimanufactures	46	--		
Iron and steel: Metal:				
Scrap	1,718	20,507	--	Japan 20,264.
Pig iron, cast iron, related materials	144,170	133,444	--	Sweden 52,500; Bangladesh 37,231; China 24,363.
Steel, primary forms	--	59,504	--	Japan 38,579; Belgium-Luxembourg 15,028.
Semimanufactures:				
Bars, rods, angles, shapes, sections	2,381	818	--	Sri Lanka 790.
Universals, plates, sheets	72	230	--	India 222.
Wire	113	134	--	Iran 100; Greece 34.
Tubes, pipes, fittings	8,264	714	--	Afghanistan 533; United Arab Emirates 108.
Castings and forgings, rough	--	4	--	All to United Arab Emirates.
Nickel: Metal including alloys, scrap	106	4	--	All to United Kingdom.
Silver: Ore and concentrate value, thousands	--	$2,212	--	China $1,146; Sweden $1,066.
Uranium and or/thorium: Metal including alloys, all forms do	--	$562	--	All to Sweden.
Zinc:				
Oxides	--	10	--	All to United Arab Emirates.
Metal including alloys, scrap	41	--		
Other:				
Ores and concentrates	5,785	100	--	All to Sweden.
Ashes and residues	250	--		
Base metals including alloys, all forms	--	17	--	All to United Arab Emirates.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	1	1	(2)	Mainly to Bangladesh.
Asbestos, crude	--	2	--	All to Bangladesh.
Barite and witherite	50	--		
Clays, crude	131	100	--	Do.
Fertilizer materials:				
Crude, n.e.s	223,620	213,594	--	United Arab Emirates 207,332; Qatar 5,500.
Manufactured: Nitrogenous	507,203	173,003	--	Iran 78,550; Bangladesh 52,453; China 42,000.
Gypsum and plaster	1,500	60	--	All to Kuwait.
Mica: Crude including agglomerated splittings	--	10	--	Do.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$1,105	$4,839	$496	Hong Kong $3,088; West Germany $413; Switzerland $360.
Synthetic do.	$20	--		
Salt and brine	9,417	18,409	500	India 12,505; Rwanda 2,142.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	7,106	5,617	39	Japan 1,064; Italy 640; Bangladesh 503.
Worked	--	20	--	All to United Kingdom.
Dolomite, chiefly refractory-grade	--	350	--	All to Bangladesh.
Gravel and crushed rock	313	395	--	Do.
Sand other than metal-bearing	--	3,194	--	United Arab Emirates 3,036.
Sulfur:				
Elemental: Colloidal, precipitated, sublimed	--	1	--	All to New Zealand.
Sulfuric acid	83	102	--	All to Afghanistan.
Other: Crude	1,087	20	--	All to Bangladesh.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	1,204	46	--	Sri Lanka 30; Bangladesh 16.
Coke and semicoke	--	20,000	--	All to Republic of Korea.
Petroleum refinery products:				
Lubricants thousand 42-gallon barrels	--	178	--	India 133; United Arab Emirates 45.
Residual fuel oil do.	1,090	906	--	Yemen (Aden) 539; United Arab Emirates 366.
Bitumen and other residues do.	--	120	--	Republic of Korea 55; Sri Lanka 48.
Bituminous mixtures do.	--	36	--	United Arab Emirates 30.

[1]Table prepared by Audrey D. Wilkes.
[2]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals	1	1	--	All from West Germany.
Aluminum:				
Oxides and hydroxides	1,815	3,007	17	China 2,204; United Kingdom 226; Japan 169.
Metal including alloys:				
Scrap	13,560	21,799	52	United Arab Emirates 5,679; West Germany 4,045; Saudi Arabia 3,074.
Unwrought	7,359	7,747	10	Bahrain 5,249; United Arab Emirates 499; U.S.S.R. 485.
Semimanufactures	7,441	7,522	72	Switzerland 993; West Germany 429; Japan 427.
Chromium:				
Ore and concentrate	--	15	--	Australia 11; United Kingdom 4.
Oxides and hydroxides	57	88	9	China 39; West Germany 16.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Cobalt: Oxides and hydroxides	3	13	5	Belgium-Luxembourg 7.
Copper:				
Matte and speiss including cement copper	--	9	--	All from Japan.
Metal including alloys:				
Scrap	115	209	--	United Arab Emirates 110; United Kingdom 80.
Unwrought	329	162	--	Japan 63; Belgium-Luxembourg 37; Netherlands 29.
Semimanufactures	8,327	9,984	--	Japan 5,535; United Kingdom 1,244; Belgium-Luxembourg 581.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	1,243	1,469	--	Brazil 419; Australia 389; Liberia 309.
Pyrite, roasted	11	--		
Metal:				
Scrap	150,415	147,210	73,502	United Arab Emirates 24,178; United Kingdom 16,084; West Germany 11,129.
Pig iron, cast iron, related materials	763	4,971	--	United Kingdom 4,048; Canada 399.
Ferroalloys:				
Ferromanganese	5,847	8,056	--	Switzerland 1,616; France 1,409; Norway 1,300.
Unspecified	3,078	54,575	2	Canada 39,583; Bahrain 8,280; China 4,132.
Steel, primary forms	3,498	9,562	5	Australia 8,238; Japan 743.
Semimanufactures:				
Bars, rods, angles, shapes, sections	38,442	35,106	49	Japan 22,019; West Germany 5,156.
Universals, plates, sheets	474,852	326,088	28,894	Japan 141,818; Australia 37,623; West Germany 31,545.
Hoop and strip	23,649	25,355	--	France 16,817; Japan 5,846.
Rails and accessories	17,162	12	--	All from Japan.
Wire	18,686	19,419	3	Republic of Korea 7,924; Japan 6,309; China 3,577.
Tubes, pipes, fittings	74,611	81,457	3,265	Japan 45,282; Republic of Korea 10,188; France 9,443.
Castings and forgings, rough	840	1,835	2	West Germany 678; United Kingdom 445; Turkey 278.
Lead:				
Ore and concentrate	368	205	--	All from Morocco.
Oxides	859	857	--	China 514; West Germany 245.
Metal including alloys:				
Scrap	221	210	--	Zambia 72; West Germany 45.
Unwrought	1,613	2,743	2	U.S.S.R. 1,116; United Kingdom 563; Zambia 431.
Semimanufactures	37	19	--	United Kingdom 18.
Magnesium: Metal including alloys, all forms	6	14	12	France 1.
Manganese:				
Ore and concentrate	33,184	229	--	All from China.
Oxides	1,532	1,799	9	Singapore 833; China 519; Japan 354.
Mercury 76-pound flasks	1,044	1,828	--	China 841; Algeria 609.
Molybdenum: Metal including alloys, all forms value, thousands	$60	$82	--	Netherlands $61.
Nickel:				
Ore and concentrate	8	--		
Matte and speiss	101	638	3	Canada 537; Philippines 75.
Metal including alloys, all forms	344	322	13	United Kingdom 148; Norway 83; West Germany 39.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$103	$3	--	All from West Germany.
Silver:				
Ore and concentrate[2] do.	$21	$14	--	Japan $11; West Germany $3.
Metal including alloys, unwrought and partly wrought do.	$97	$75	--	West Germany $71.
Tin:				
Ore and concentrate	48	--		
Metal including alloys, all forms	161	617	(3)	Malaysia 555; Belgium-Luxembourg 30.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Titanium: Oxides	2,505	3,339	194	United Kingdom 1,941; West Germany 462; Japan 253.
Tungsten:				
Ore and concentrate	--	1	--	All from Hong Kong.
Metal including alloys, all forms value, thousands	$568	$591	--	Netherlands $472; Hungary $78.
Uranium and thorium:				
Ore and concentrate do	$132	$50	--	All from Australia.
Metal including alloys, all forms do	$14	$13	--	China $9; Switzerland $4.
Zinc:				
Ore and concentrate	1	--		
Oxides	302	294	--	France 170; Belgium-Luxembourg 56.
Metal including alloys:				
Scrap	1,115	--		
Unwrought	10,291	14,634	50	Spain 5,116; U.S.S.R. 2,349; China 1,634.
Semimanufactures	18	114	--	Spain 99.
Other:				
Ores and concentrates	178	424	--	Australia 326; China 50.
Oxides and hydroxides	(4)	--		
Base metals including alloys, all forms	100	78	--	Hong Kong 31; China 30; Japan 15.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	788	936	169	Netherlands 409; China 197.
Artificial: Corundum	159	64	--	France 20; Spain 18; Brazil 13.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$7	$8	--	United Kingdom $5; Italy $3.
Grinding and polishing wheels and stones	484	783	4	China 412; West Germany 132.
Asbestos, crude	3,349	4,383	--	Canada 2,431; Singapore 1,647.
Barite and witherite	113	6	--	All from China.
Boron materials:				
Crude natural borates	--	77	--	All from Turkey.
Oxides and acids	348	406	--	China 345; Italy 47.
Cement thousand tons	555	132	(3)	U.S.S.R. 49; Japan 30; West Germany 11.
Chalk	6,192	7,594	--	Belgium-Luxembourg 5,305; United Kingdom 968.
Clays, crude	35,837	65,845	3,194	United Kingdom 58,706.
Cryolite and chiolite	2	1	--	All from Denmark.
Diatomite and other infusorial earth	213	143	103	Netherlands 34.
Feldspar, fluorspar, related materials	226	207	--	Italy 60; China 45; United Kingdom 42.
Fertilizer materials: Manufactured:				
Ammonia	14	24	10	United Kingdom 10.
Nitrogenous	--	65,481	--	Romania 26,756; Kuwait 24,025; Saudi Arabia 14,700.
Phosphatic	428,247	654,981	570,048	West Germany 31,474; Netherlands 28,035.
Unspecified and mixed	37,012	26,501	--	Norway 13,965; Finland 12,536.
Graphite, natural	1,238	1,959	--	China 1,088; Sri Lanka 190.
Gypsum and plaster	182	(5)	--	Mainly to Japan.
Lime	2	25,013	--	Italy 25,000.
Magnesium compounds: Magnesite, crude	942	486	70	China 168; Netherlands 67; West Germany 54.
Mica: Worked including agglomerated splittings	5	2	(3)	Afghanistan 1.
Nitrates, crude	--	46	46	
Phosphates, crude	200,843	147,975	--	All from Jordan.
Pigments, mineral: Iron oxides and hydroxides, processed	2,025	2,571	--	China 1,993; West Germany 435.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$160	$162	--	Thailand $67; Hong Kong $32; Australia $24.
Synthetic do	$6	$11	--	Austria $5; France $2.
Pyrite, unroasted	117	(6)		
Salt and brine	143	(7)		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sodium compounds, n.e.s.: Carbonate, manufactured	113	51	--	United Kingdom 27; West Germany 24.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	3,069	462	--	Italy 461.
Worked	1,171	919	--	All from Italy.
Dolomite, chiefly refractory-grade	769	1,160	--	Italy 1,049; Norway 109.
Gravel and crushed rock	97	--		
Quartz and quartzite	--	19	--	All from United Kingdom.
Sand other than metal-bearing	339	253	--	United Arab Emirates 173; United Kingdom 53.
Sulfur:				
Elemental:				
Crude including native and by-product	40,505	27,185	--	Kuwait 11,877; Qatar 8,142; Afghanistan 3,146.
Colloidal, precipitated, sublimed	1,629	851	--	United Arab Emirates 523; China 194; Republic of Korea 78.
Sulfuric acid	22	13	1	Norway 6; United Kingdom 5.
Talc, steatite, soapstone, pyrophyllite	876	13,638	--	China 13,457.
Other:				
Crude	13,895	18,830	14	China 16,044; Singapore 2,180.
Slag and dross, not metal-bearing	65	44	--	United Arab Emirates 42.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	11,804	4,514	101	Singapore 4,403.
Carbon black	681	2,132	13	Republic of Korea 1,136; China 559.
Coal:				
Anthracite and bituminous	770,141	810,234	109,919	Australia 545,676; Canada 154,499.
Lignite including briquets				
value, thousands	--	$11	--	All from West Germany.
Coke and semicoke	5	29	--	All from United Kingdom.
Peat including briquets and litter	9	--		
Petroleum:				
Crude thousand 42-gallon barrels	31,055	26,933	--	Saudi Arabia 18,353; United Arab Emirates 5,669; Iran 2,911.
Refinery products:				
Liquefied petroleum gas				
value, thousands	$5	--		
Gasoline				
thousand 42-gallon barrels	855	875	--	Kuwait 872.
Mineral jelly and wax ---do---	75	76	--	China 46; Iraq 17.
Kerosene and jet fuel ---do---	3,931	4,051	--	Kuwait 3,996.
Distillate fuel oil ---do---	10,449	11,777	--	All from Kuwait.
Lubricants ---do---	159	61	7	West Germany 22; United Kingdom 8.
Residual fuel oil ---do---	7	66	--	China 59.
Bitumen and other residues				
do---	21	(3)	--	All from Italy.
Bituminous mixtures ---do---	(3)	20	--	Austria 12; United Kingdom 8.

[1]Table prepared by Audrey D. Wilkes.
[2]May include platinum-group metals.
[3]Less than 1/2 unit.
[4]Revised to zero.
[5]Unreported quantity valued at $4,000.
[6]Unreported quantity valued at $275,000 imported from the United States.
[7]Unreported quantity valued at $273,000 mainly imported from Denmark.

COMMODITY REVIEW

Chromite.—Pakistan's modest chromite mining industry achieved a 20% increase in output of this important ferroalloying commodity. It was the third consecutive year in which growth was recorded. Although monthly output declined following banner months in July and August, production in the waning months was ahead of the 1986 pace.

Copper.—The Metallurgical Construction Corp. a consortium of Romanian, Finnish, Swedish, and Chinese entities, submitted a

preliminary proposal in September and a detailed proposal in December offering to build on a turnkey basis a $303 million facility over a 3-1/2-year period to bring the Saindak copper deposit into operation. The facility's design calls for the production of 16,400 tons per year of blister copper which, at least at the outset, would contain about 51,800 troy ounces of gold and 72,300 troy ounces of silver. Presumably, the latter metals would be recovered from the blister copper abroad, for the proposal seemingly did not include installation of a copper refinery. The ore mined at Saindak would also provide an exportable molybdenum concentrate, while pyrite and magnetite components of the ore would be retained in Pakistan, either for local treatment or export at some future time. The proposal was accepted by the Government of Pakistan, and at yearend, plans were in the offing for visits by a technical team to Chinese mines and metallurgical facilities.

Gold.—Although there was no reported gold output in Pakistan through 1987, there is the opportunity for such output as a byproduct, almost a coproduct, with copper, if and when the Saindak copper complex comes on-stream with its projected annual output of 51,800 ounces. The gold would be recovered abroad from blister copper produced at the Saindak facility, at least at the outset.

During the year, the reported Karachi prices for gold advanced from $467 per ounce on January 1 to over $580 per ounce on December 31, an increase of 24%; these prices were 15.5% and 19.2%, respectively, above the London prices on those dates.

Iron and Steel.—Company sources indicated that Pakistan Steel Mills Corp.'s Bin Qasim steelworks reached its rated capacity during 1987, presumably signaling that the facility passed the break-even point. For several years since the inception of operations at the country's only integrated steel plant, output has reportedly been kept in check to avoid exceeding demand. A surplus was regarded as potentially damaging to the smaller, nonintegrated, private-sector steel mills of the country and to the nation's rather substantial shipbreaking industry.

The latter emerged during the late 1970's and the early 1980's as a significant provider of scrap steel in Pakistan, a development that was paralleled in other Asian countries such as Bangladesh, China, the Republic of Korea, and Taiwan, which like Pakistan have the relatively low wages and large populations that are compatible with the labor-intensive nature of the shipbreaking industry.

However, in 1987 spokesmen for Pakistan's shipbreaking industry expressed their belief that the increases in output by Pakistan Steel had resulted in substantial overcapacity in the country. They said their industry was in a decidedly disadvantageous financial position with respect to both Pakistan Steel and the several steel rerolling plants that operate largely on imported scrap in the traditional forms. The Pakistan Ship Breakers Association alleged that this relatively poorer position was primarily the result of what they viewed as inequitable import duties and sales taxes. These charges, the shipbreakers said, had averaged 1,200 rupees (about $72) per ton over the past 3 years, for their members compared with only 41 rupees (about $2.50) per ton for the scrap rerollers.

The shipbreakers suggested that the duty structure was unfavorable not only for their industry, but for Pakistan Steel and the steel remelters as well, in comparison with scrap rerollers. They noted that the number of shipbreaking firms had declined from 200 to 70, and that the labor force employed had dropped from 30,000 to 20,000.

When the Government did not respond to the industry's formal presentation of its views, the Ship Breakers Association called a complete strike in late June which, it was claimed, led to a loss of 300,000 rupees per day for the industry as a whole. The overall effect of the industry's unsatisfactory economic situation and of the strike remained to be assessed at yearend, but assuredly there was a direct loss to the economy not only from the industry's lack of activity, but also from the lay off of 10,000 workers. Longer term effects could well include the loss of a once-prosperous industry.

Silver.—As in the case of gold, Pakistan through 1987 had no officially recorded mine production of silver, but should the Saindak copper project come into operation at its rated capacity, a production of over 72,000 ounces of silver annually can be expected. Recovery of silver at the outset of the Saindak project would be out of the country, where the gold- and silver-bearing blister copper would be refined.

INDUSTRIAL MINERALS

Cement.—At yearend, there were eight private-sector cement companies in Pakistan, each with a single plant. The public sector State Cement Corp. of Pakistan (Pvt.) Ltd., had 13 separate operating units, in-

cluding 2 that had 2 plants each. The private-sector companies, with their plant locations and available information on kiln capacities, were as follows:

Company	Plant location	Kiln capacity (thousand tons)
Anwarzaib Cement Industry	Bholari	50
Attock Cement Ltd	Hub Chowki	600
Cherat Cement Co. Ltd	Cherat	330
Dadabhoy Cement Ltd	Kalu Kohar	300
Fecto Cement	Taxila	600
Galadari Cement Ltd	Hub Chowki	NA
Pakland Cement Ltd	Dhabeji	330
Sarela Cement Ltd	Darwaza	75

NA Not available.

The operating units of the State Cement Corp. and their plants, with kiln capacities were as follows:

Company	Plant location	Kiln capacity (thousand tons)
Associated Cement	Rohri	270
	Wah	450
Charibwal Cement Co	Jhelum	540
Dandot Cement Co. Ltd	Dandot	305
Javendan Cement Ltd	Mangho Pir	600
D. G. Kahn	Dera Ghazi Khan	NA
Kohat Cement Ltd	Kohat	300
Maple Leaf Cement Factory Ltd	Iskanderabad	300
Mustenkam Cement Ltd	Hahar	630
National Cement Industries Ltd	Dandot	61
	Karachi	170
Pak Cement Co. Ltd	Daud Kel	[1]171
Thatta Cement Co. Ltd	Thatta	300
White Cement Industries Ltd	Iskanderabad	30
Zeal Pak Cement Factory Ltd	Hyderabad	1,080

NA Not available.
[1]Due on-stream by or before 1988.

The aggregate listed kiln capacity of the plants listed was 7,492,000 tons excluding the Galadari Cement Ltd. plant in the private sector and the D. G. Kahn plant in the public sector.

Rather curiously, official Pakistan; Government statistics on cement production listed output by only 18 "reporting factories" during 1987, a number difficult to reconcile with the foregoing list of plants. Official production data were revised in the February 1988 issue of the Monthly Statistical Bulletin not only for 1986, but for years back to the second half of 1984, to incorporate data for additional plants. In the revised array, the results for July 1984 through June 1985 included figures for 14 plants (13 prior to revision), the figures for July 1985 through June 1986 incorporated data for 17 plants (14 prior to revision), and the results for July 1986 through December 1987 included data for 18 plants (14 prior to revision). It would appear that further increases in the number of facilities canvassed will be necessary in order to achieve complete reporting, and the increases could be substantial, depending upon which installations have not been counted.

Cement stocks in Pakistan remained quite small relative to total demand; at yearend 1986, they totaled only 157,000 tons. Monthend stocks through the year averaged only 145,000 tons, fluctuating between a low of 114,000 tons (April 30) and a high of 175,000 tons (June 30). At yearend, stocks totaled 171,000 tons.

Fertilizer Materials.—Agriculture has remained the largest industrial sector in Pakistan in terms of gross national product, gross domestic product, employment, and export earnings. With the population at 99 million and growing at 3% per year, the Government has directed considerable attention to the nation's fertilizer industry, a key to sustaining agricultural output.

At yearend 1987, the country had nine chemical fertilizer plants in operation, five producing urea only, one producing ammo-

nium sulfate, two producing single superphosphate, and one producing ammonium nitrate, urea, and nitrophosphate. These plants, with their yearend 1987 rated annual capacities, were as follows: National Fertilizer Corp. Ltd.'s (NFC) Pak-Saudi plant at Mirpur Mathelo, 256,000 tons nitrogen in urea; NFC's Pak China plant at Haripur, 44,000 tons nitrogen in urea; Exxon Chemicals (Pvt.) Ltd.'s Daharki plant, 118,000 tons nitrogen in urea; Dawood Hercules Chemicals Ltd.'s Chichoki Mallian plant, 160,000 tons nitrogen in urea; Fauji Fertilizer Co.'s Sadiqabad plant, 262,000 tons nitrogen in urea, NFC's Pak American plant, 19,000 tons nitrogen in ammonium sulfate; NFC's Lyallpur Chemicals plants at Faisalabad, 3,000 tons P_2O_5 in single superphosphate, and at Jaranwala, 13,000 tons P_2O_5 in single superphosphate; and NFC's Pak-Arab plant at Multan, 117,000 tons nitrogen in ammonium nitrate, 41,000 tons nitrogen in urea, and 70,000 tons nitrogen in nitrophosphate. Additionally, Pakistan Steel Mills at Karachi had the capacity to produce 4,000 tons of nitrogen in ammonium sulfate as a byproduct of its steel operations.

Actual 1987 output of products on a gross weight basis (1986 results in parentheses) was as follows: ammonium nitrate, 372,934 (405,808); ammonium sulfate, 90,296 (92,127); nitrophosphate, 316,890 (316,793); superphosphate, 103,464 (106,880); and urea, 1,994,993 (1,888,450). Thus, although the output of urea advanced by 5.6%, production of nitrophosphate was only a few tons above the 1986 level, and production of the other three products fell. Nonetheless, the gain in ammonium nitrate more than compensated in terms of total nitrogen content. Plant-by-plant details on urea output indicated that three of the urea-only plants produced in excess of design capacity, the Exxon facility operated at capacity, and the Haripur plant (urea only) and Multan plant (urea works) fell slightly short of design capacity.

MINERAL FUELS

In 1987, natural gas, all domestically produced, accounted for 63.1% of Pakistan's total primary energy production of about 18.2 million tons, standard coal equivalent (SCE), far ahead of the 15.2% provided by petroleum, the 12.3% provided by hydroelectric and nuclear powerplants, and the 9.3% supplied by commercial solid fuels. The 1987 level of energy production was nearly 8.6% above that of 1986, when natural gas provided 65.1% of the total; petroleum, 16.3%; hydroelectric and nuclear powerplants, 10.3%; and commercial solid fuels 8.3%, from a total (revised) of 16.9 million tons SCE. In 1986, the most recent year for which complete energy-materials-consumption figures were available, domestic energy sources accounted for almost 65.9% of total energy consumption (excluding bunker loadings) of 25.6 million tons SCE. Of this total, natural gas accounted for 42.9%; liquid fuels, 41.6%; commercial solid fuels, 8.7%; and hydroelectric and nuclear electricity, 6.8%. In terms of SCE, about 26% of the liquid fuels consumed was produced domestically, whereas almost 63% of the commerical solid fuels consumed came from Pakistan's mines.

Coal.—An increase of 20.7% in coal output significantly raised that commodity's share of total Pakistani energy production. The change was in line with the national policy to reduce reliance on imported fuels.

Natural Gas.—During 1987, data was published on Pakistan's natural gas reserves as of July 1, 1986. Proven reserves were stated to be 11,445 billion cubic feet, or nearly 66% of the reported "original reserves." The resources total was distributed by gasfield as follows, listed in descending order of quantity, in billion cubic feet (figures in parentheses represent each field's original reserves): Sui, 4,838 (8,624); Pirkoh, 3,179 (3,470); Mari, 2,561 (44,034); others (Meyal, Khandot, Dhuenal, and Toot), 867 (1,038). The Dhulian, Hundi, and Sari Fields, with a collective original reserve of 278 billion cubic feet, were reported essentially to be depleted as of July 1, 1986. No reserve figures were provided for 14 other gasfields that have been identified.

Petroleum.—Pakistan's petroleum industry recorded output gains in both the production of crude oil and refinery products; however, the gain in refined oils, based in large part upon imported crude, was larger than that for domestic crude output, thus reflecting a growth in crude oil imports. This was clearly preferable to importing higher unit value refinery products. It was not as desirable from the viewpoint of Pakistan's foreign exchange situation as would have been a refinery increase based on domestic crude. The 1.1% growth in domestic crude oil output fell short of governmental hopes but at least was a shift in the desired direction. The glut of crude oil and attendant reduced prices on world markets worked in Pakistan's favor.

Information released by the Ministry of Petroleum and Natural Resources on field-

by-field crude oil production for July 1, 1986, to March 31, 1987, indicated that Dhurnal Field remained the country's leading producer, accounting for 36.6% of total output of Pakistan's 14 operating fields during that period. Other leading fields and their shares of the total, were Leghari, 19.7%; Tando Alam, 9.2%; Khaskeli, 8.6%; Meyal, 8.3%; Mazari (in its first appearance among producers), 5.9%; Dhabi, 5.5%; and Toot, 3.9%. The remaining 2.3% was from Balkassar, Joyamir, Ghotana, Dhulian, Finkassar, and Khuar (listed in order of volume of output). Of these minor producers, Ghotana, with 52,000 barrels, was in its first year of production, whereas Khuar, with only 3,000 barrels, has been in operation since 1915. In July 1987, the Chak Naurang Field at Chakwal was inaugurated, raising the number of operating fields to 15. At least seven more fields were listed with reserves, but these were not yet operational. They included Mazari South, Nari, Tajedi, Turk, Liari, Halipota, and Tando Muhammad Khan Taluka, and there were additional possible commercial oil finds at Thora, Sono, Chatana, Chak Naurang, and Lashari (South), all in the Sunghar and Wassi concession blocks near Hyderabad, and at Ghanghoo in the Bohin concession block.

Data of the Ministry of Petroleum and Natural Resources covering the fiscal year ending June 30, 1986, and the 9 months ending March 31, 1987, indicated that the transport sector of the economy consumed 48.3% of the petroleum products used in Pakistan during that 21-month period. Power generation used 14.2%; the industrial sector, 13.4%; households, 11.3%; the agricultural sector, 3.4%; and other government agencies (presumably including a variety of uses), the remainder. Comparison with data for the fiscal year ending June 30, 1981, shows declines in the shares of total use by the transport, agriculture, household, and government-agency sectors, and increases in the shares of use by industry and power generators. In terms of annual product consumption, there was an increase of 64% between the fiscal year ended June 30, 1981, and that ended June 30, 1986. Based on the 9-month data released, the projected consumption increase for the fiscal year ending June 30, 1987, was very small.

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[1]Senior foreign mineral specialist, Division of International Minerals.

[2]Where necessary, values have been converted from Pakistan rupees to U.S. dollars at the following rates: 1985—PRs15.928=US$1.00; 1986—PRs16.648=US$1.00; and 1987—PRs17.399=US$1.00.

The Mineral Industry of Peru

By Pablo Velasco[1]

The Peruvian mineral sector faced continued rising operational costs, labor problems, terrorism, high inflation of 115%, and increased difficulties in obtaining foreign currency to import supplies and spare parts. After being frozen for almost 2 years, the exchange rate for the mining sector "dolar minero," one of the several exchange rates existing in the country, was increased from about 16 intis per US$1.00 in early 1987 to 40 intis per US$1.00 in December 1987. The official exchange rate dropped 65% in the last quarter of 1987 from 20 intis per US$1.00 in October to 33 intis per US$1.00 in December. However, despite these changes in foreign exchange rates, that applicable to the mineral sector was behind the country's inflation rate.

State-owned companies such as Minero Perú Comercial S.A. (Minpeco), Empresa Minera del Centro del Perú S.A. (Centromín Perú), Empresa Minera del Perú S.A. (Minero Perú), Empresa Minera del Hierro del Perú S.A. (Hierro Perú), etc., have benefited from local-currency financing by state-controlled financial institutions and from other inflows of fresh capital. Most private sector mining companies were able to end the year with weak-to-moderate after-tax earnings. Several small mines suspended operations for lack of working capital, new equipment, supplies and spare parts.

Peru by tradition is a mineral producing and exporting country. The mineral sector contributes approximately 10% to the country's gross domestic product, earns about 50% of the total export revenues, and is considered the backbone of the economy. Mining greatly contributes to the national integration and regional development by offering work opportunities, establishing access roads, and bringing in educational and health services. The mineral sector, therefore, has a direct impact on the country's economy. In 1987, Peru ranked 2d in silver and bismuth production after Mexico, 3d in zinc, 6th in lead, and 10th in copper.

Government Policies and Programs.— The most important mineral legislation issued during the year concerned the marketing of minerals and metallurgical products. In May, Supreme Decree 005-87-EM/DGM was signed by the Peruvian Government. This decree gave the state marketing company, Minpeco, the right of first refusal in mineral sales contracts. In accordance with this decree, all Peruvian mineral producers and/or metal traders had to comply with a series of obligations, which created great concern in the mineral sector. However, in August, after strong opposition from the mineral sector and the Mining Society, the Government signed Supreme Decree 008-87-EM/DGM. This edict partially canceled Minpeco's right to first refusal, allowed Peruvian mineral producers to issue tenders for the sale of their mineral products abroad but allowed Minpeco to buy such tenders, and gave Minpeco the option to buy the mineral production as long as the commercial and financial terms were competitive. The decree also authorized the Central Reserve Bank (CRB) to buy directly or through Minpeco the silver contained in all ore concentrates and metallurgical products to be exported. Moreover, it authorized the CRB and Minpeco to enter international markets to buy silver with CRB financial resources. In addition, all silver producers were allowed to carry out hedging operations not to exceed 25% of their total production, providing that these were guaranteed with the sale of their own production. These modifications were well received by the mineral sector. At yearend, the Government also issued a series of provi-

sions to revitalize the small- and medium-size mining companies through rescheduling and refinancing their debts.

In the mineral fuel sector, the Government approved Law 24782 making significant changes in Peru's petroleum law. All new contracts will provide for an exploration phase of up to 6 years, including a basic 4-year period divided into two stages with a possible 2-year extension. The maximum duration of oil contracts, including both exploration and production phases, remained 30 years. Contracts for the development and production of nonassociated natural gas could not exceed 40 years. The creation and growth of the domestic market, the investment recovery period, and the feasibility of any export project had to be taken into account when setting the period for gas contracts. Exploration blocks for both oil and gas would be a maximum of 1 million hectares in the jungle regions, 500,000 hectares in the highlands, 400,000 hectares in the continental shelf, and 200,000 hectares on the coast. One-half of such areas was to be returned to the Government upon transition from the exploration phase to the production phase.

A contractor could be assigned as many as three blocks and through a Supreme Decree, a fourth block. In the case of contracts involving the construction of a major gas or oil pipeline and related facilities, contractors were required to offer Petróleos del Perú (Petroperú), the state-owned petroleum company, no less than 50% of the investment; the latter may or may not accept participation. At the end of the contract period, all pipeline installations and related facilities could be transferred to Petroperú at no cost.

The new law stated that the CRB would guarantee to foreign contractors the availability of foreign currency required. The new law also gave priority to the construction of catalytic cracking units or other alternate processes in the Pampilla and Iquitos refineries.

PRODUCTION

According to statistical information released by the Peruvian Ministry of Energy and Mines, the country's mining industry overcame serious difficulties, to register increases in production in 1987. Metal output was up despite operational problems and strikes at major state producer Centromín Perú, private copper producer Southern Peru Copper Corp. (SPCC), Hierro Perú, and private zinc producer Empresa Minera San Ignacio de Morococha S.A. (San Ignacio). Some medium and small mines suffered production setbacks as a result of a shortage of supplies and spare parts.

Copper production increased more than 2%. On a sector-by-sector basis, the output of the large mines rose by 2%, the medium mines by 4%, and the small mines by 1%. Production of copper from state mining companies also increased more than 2%. During 1987, the main copper producers in Peru were SPCC, Empresa Minera Especial Tintaya S.A., Centromín Perú, Cía. Minera Pativilca S.A., Cía. Minera Condestable S.A., Cía. Minera Raura S.A., and Sindicato Minera Pacococha S.A.

Lead production increased by 5% to almost 204,000 tons. Centromín Perú, in particular, increased lead output by 14%, while the medium mines registered a drop of 2%, and the small mines increased by 9%. State producer Centromín Perú and private producers Cía. Minera Milpo S.A., Cía. Minera Atacocha S.A., Cía. Minera Santa Luisa S.A., Sociedad Minera El Brocal S.A., Cía. Minera Huarón S.A., Raura, San Ignacio, and Corp. Minera Nor Perú S.A. were listed as the major lead producers in Peru in 1987.

Zinc production in 1987 increased 3%. The large-scale mining sector increased output of concentrates by 12%. The medium mines suffered a 4% drop in output, due mainly to lower production by San Ignacio, whose San Vicente Mine was paralyzed by a 30-day strike during the last quarter. Other companies that experienced an output drop were Milpo, Raura, Cía. Minerales Santander S.A., and Santa Luisa. Small mines increased output by 9%. Zinc production at Centromín Perú was up by 12%. Other major zinc producers during the year were Cía. Minera Perubar S.A., Atacocha, Cía. Minera Volcán S.A., and El Brocal.

Total silver production in Peru rose by 7%, with the large mines sector increasing output by 12%. Increased silver production was also recorded by the medium (4%) and small mines sectors.

State mining companies increased production by 14% and accounted for 26% of domestic silver output. The main silver producers were Centromín Perú, Cía. de Minas Buenaventura S.A., Cía. de Minas Orcopampa S.A., Cía. de Minas de Arcata S.A., Huarón, Nor Perú, SPCC, Cía. Minera de Caylloma S.A., and Santa Luisa, in order of output.

Iron ore production remained stable de-

spite the work stoppage at Hierro Perú during the second half of 1987. The general weak market caused by lower world steel production and new mine capacity made the situation more difficult for Hierro Perú in international trade.

Tin production from the country's sole producer, Minsur S.A., reached almost 5,300 tons, a 9% increase. Gold production declined 7.5% to about 263,200 troy ounces.

Total crude oil output in 1987 dropped 8% to 60 million barrels (163,644 barrels per day), in response to lower world prices. Natural gas production was approximately 50 billion cubic feet, the same level achieved in 1986. The interior jungle areas contributed 64% of the total, followed by the coastal areas, 21% and the continental shelf, 15%.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Antimony:					
Mine output, Sb content	713	672	594	[e]670	590
Metal	323	372	377	359	[2]318
Arsenic, white[3]	1,009	1,090	1,257	1,273	[2]1,221
Bismuth:					
Mine output, Bi content	678	650	785	[e]680	460
Metal	526	651	738	605	[2]413
Cadmium:					
Mine output, Cd content	897	674	579	463	[2]461
Metal	451	390	420	387	[2]351
Copper:					
Mine output, Cu content	318,780	353,927	391,332	397,364	[2]406,430
Sulfate (Cu content)	2,491	2,535	2,539	2,234	[2]2,078
Metal:					
Smelter	258,305	298,806	326,592	286,167	[2]286,575
Refined	161,369	188,571	226,787	225,614	[2]218,365
Electrowon	33,008	31,450	27,434	27,533	27,500
Gold:					
Mine output, Au content troy ounces	168,534	187,406	212,870	284,373	[2]263,186
Metal do.	72,789	79,734	84,653	84,074	[2]64,977
Indium kilograms	2,704	2,903	3,863	3,333	[2]3,890
Iron and steel:					
Iron ore and concentrate:					
Gross weight thousand tons	4,287	3,979	4,892	5,036	[2]5,019
Fe content do.	[r]2,893	[r]2,663	3,290	3,356	[2]3,358
Metal:					
Pig iron[4] do.	113	[r]4	163	216	[2]192
Ferroalloys do.	320	--	--	--	--
Steel ingots and castings thousand tons	299	[r]337	397	487	[2]502
Semimanufactures do.	243	346	304	377	[2]408
Lead:					
Mine output, Pb content	207,350	193,652	201,460	194,378	[2]203,950
Metal	67,662	70,192	81,895	66,417	[2]66,421
Manganese, mine output, Mn content	--	273	334	119	200
Molybdenum, mine output, Mo content	2,642	2,974	3,807	3,484	[2]3,353
Selenium metal, refined kilograms	19,514	20,758	14,506	12,035	[2]11,438
Silver:					
Mine output, Ag content thousand troy ounces	50,477	53,080	58,230	61,916	[2]66,052
Metal, refined do.	24,814	26,885	24,159	21,442	[2]20,717
Tellurium metal kilograms	15,806	14,066	15,007	9,836	[2]7,317
Tin, mine output, Sn content	2,808	3,314	3,807	4,817	[2]5,263
Tungsten, mine output, W content	762	699	771	742	[2]664
Zinc:					
Mine output, Zn content	491,668	465,890	523,434	597,576	[2]612,477
Metal	153,966	148,372	162,904	155,882	[2]145,092
INDUSTRIAL MINERALS					
Barite	111,117	46,323	21,661	9,945	10,000
Boron materials, crude (borates)[e]	10,000	10,000	10,000	[2]22,557	20,000
Cement, hydraulic[e] thousand tons	1,965	1,869	[r]1,757	[r]2,128	2,000
Chalk[e]	470,000	470,000	470,000	470,000	470,000
Clays:					
Bentonite	15,110	12,971	2,017	33,080	30,000
Fire clay	4,448	5,601	4,305	[e]5,000	5,000
Kaolin	586	[e]1,000	210	6,328	5,000
Common clay	225,917	269,123	115,588	406,587	400,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Diatomite	13,698	7,471	14,854	10,390	14,500
Feldspar	2,509	3,225	--	19,467	10,000
Gypsum, crude	77,143	66,722	28,640	172,619	150,000
Lime[e]	35,000	35,000	35,000	35,000	35,000
Mica[e]	550	550	550	550	550
Nitrogen: N content of ammonia[e]	85,000	85,000	85,000	85,000	85,000
Phosphates, crude	2,510	12,694	12,216	18,250	[2]19,215
Salt, all types	149,832	253,027	204,992	399,387	400,000
Stone, sand and gravel:					
Stone:					
Dolomite	11,900	4,565	1,635	[e]2,000	2,000
Flagstone	--	--	--	467,766	400,000
Limestone thousand tons	1,276	1,906	2,031	2,935	2,500
Marble	6,179	5,396	1,550	7,258	6,000
Onyx	--	--	--	143	150
Quartz and quartzite (crushed)	2,303	2,465	2,150	[e]2,200	2,000
Shell, marl	--	--	--	5,437	5,000
Slate[e]	18,000	18,000	18,000	18,000	18,000
Travertine	--	--	--	4,082	4,000
Sand and gravel:					
Construction thousand tons	2,583	2,421	1,902	3,034	2,500
Silica sand do	52	53	2	99	60
Sulfur:					
Elemental:					
Native[e]	100	100	100	100	100
Byproduct of metallurgy	64,709	64,256	68,145	66,300	66,000
Sulfuric acid, gross weight	200,359	199,431	182,031	207,190	200,000
Talc and related materials:					
Talc	195	510	500	1,754	1,500
Pyrophyllite	5,037	8,728	--	7,354	7,000
Total	5,532	9,238	500	9,108	8,500
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	2,154	5,329	5,949	5,439	5,000
Coal:					
Anthracite, run-of-mine	120,000	84,000	92,750	[e]90,000	90,000
Bituminous, run-of-mine	--	--	46,310	[e]40,000	40,000
Total	120,000	84,000	139,060	[e]130,000	130,000
Coke, all types[e]	10,000	10,000	10,000	10,000	10,000
Gas, natural:					
Gross million cubic feet	42,100	45,484	47,256	50,012	49,279
Marketed[e] do	22,000	22,000	22,000	22,124	18,440
Natural gas liquids:					
Natural gasoline and other[5] thousand 42-gallon barrels	53	190	249	240	[2]299
Propane do	6	49	81	69	[2]65
Butane do	3	6	6	6	[2]9
Total do	62	245	336	315	[2]373
Petroleum:					
Crude do	62,454	67,374	68,788	64,800	[2]59,730
Refinery products:					
Gasoline, motor do	10,835	11,539	11,627	11,702	[2]11,653
Jet fuel do	2,718	2,654	2,377	2,551	[2]2,269
Distillate fuel oil do	9,591	12,020	12,389	10,577	[2]10,831
Residual fuel oil do	21,637	26,617	25,652	27,441	[2]29,675
Lubricants do	57	63	58	61	[2]63
Liquefied petroleum gas do	1,170	1,429	1,407	1,577	[2]1,620
Asphalt do	178	212	271	333	[2]262
Refinery fuel and losses do	596	386	537	1	[2]4
Other do	2,090	1,074	1,536	1,131	[2]1,079
Total do	54,896	62,214	62,207	62,314	[2]61,818

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

[1]Table includes data available through Aug. 28, 1988. Where appropriate, data have been revised to conform with that reported in Anuario de la Minería Perú, 1977-85, Ministerio de Energía y Minas, Lima, 1986, 167 tables. Production figures for 1986-87 do not necessarily reflect recoverable metal content as do those for prior years.

[2]Reported figure.

[3]Output reported by Empresa Minera del Centro del Perú S.A.

[4]Excludes sponge iron production as follows, in tons: 1983—27,024; 1984—62,121; 1985—44,311 (revised); 1986—55,496 (revised); and 1987—60,100.

[5]Includes hexane.

TRADE

Export volumes of all major metals except gold and zinc increased. The value of mineral exports rose by 9% to $1.2 million, due mostly to the unexpected increase in metal prices during the last months of the year. Nonfuel minerals accounted for 46% of the total value of mineral exports. Copper alone represented almost 20%, while lead (mainly due to the silver content in concentrates) and zinc accounted for 10% each. Exports of silver, iron ore, gold, and other metals accounted for the remaining share.

Domestic gold sales by the Banco Minero amounted to 164,000 troy ounces, of which 85% was sold to the CRB to increase its international reserves. The rest was sold to local jewelers and dentists. The Government in 1987 authorized temporary imports of about 70,000 ounces of refined gold to satisfy the increased domestic demand. Legal exports of silver dropped by 23% to 14.4 million troy ounces due to an increase in domestic consumption. Centromín Perú's sales of silver in domestic markets increased by 243%, reaching more than 7 million ounces.

Because of declining domestic production, Peru stopped exporting crude oil. It imported crude for the first time since 1974, with an initial shipment of about 2 million barrels of light crude oil. Imports of refinery products also increased, while exports of refinery products dropped.

Minpeco's "silver lawsuit" in the U.S. District Court for southern New York continued at yearend. In 1987, Minpeco obtained $55 million through settlements with Banque Populeire Suisse, E. F. Hutton, Merrill Lynch, and Prudential Bache.

The average foreign exchange rates in 1986 and 1987 were 17.76 and 31.40 intis per US$1.00, respectively.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	Destinations, 1984	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	--	5	--	All to Chile.
Metal including alloys, semimanufactures	18	1	--	Do.
Chromium: Ore and concentrate	--	322	--	Do.
Copper:				
Ore and concentrate	49,755	94,297	--	Japan 73,011; Spain 2,794; West Germany 1,976.
Metal including alloys:				
Unwrought	59,181	112,753	17,369	Japan 24,693; United Kingdom 20,529.
Semimanufactures	8,302	10,141	4,730	Costa Rica 1,749; Colombia 1,124.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite -- thousand tons	1,259	3,925	25	Republic of Korea 1,696; Japan 1,280; Netherlands 517.
Metal:				
Ferroalloys	88	--		
Steel, primary forms	2,998	--		
Semimanufactures:				
Bars, rods, angles, shapes, sections	51	729	--	Bolivia 480; Chile 184; Ecuador 37.
Universals, plates, sheets	7,353	158	--	All to Venezuela.
Hoop and strip	1	--		
Rails and accessories	1	4	--	Bolivia 3; Chile 1.
Wire	76	28	--	Bolivia 24; Colombia 4.
Tubes, pipes, fittings	189	743	--	Colombia 723; Venezuela 18; Bolivia 2.
Castings and forgings, rough	1,074	2,888	--	Chile 1,690; Bolivia 955; Colombia 154.
Lead:				
Ore and concentrate	234,577	240,124	67,385	Belgium-Luxembourg 80,139; Japan 50,414.
Oxides	1,294	708	--	Venezuela 270; Colombia 248; Chile 74.
Metal including alloys:				
Unwrought	58,035	65,343	13,715	Italy 12,000; Portugal 8,704.
Semimanufactures	8	61	61	
Nickel: Ore and concentrate	1,555	--		

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	Destinations, 1984	
			United States	Other (principal)
METALS —Continued				
Silver:				
Ore and concentrate[2] value, thousands	$3,446	$7,090	$778	West Germany $3,373; Belgium-Luxembourg $2,898.
Metal including alloys, unwrought and partly wrought do.	$256,540	$195,990	$130,154	United Kingdom $25,635; Brazil $15,151.
Tin:				
Ore and concentrate	567	3,229	2,502	Mexico 464; West Germany 263.
Metal including alloys:				
Unwrought	2	3	--	Ecuador 2; Chile 1.
Semimanufactures	68	13	--	Guatemala 10; Venezuela 2; Panama 1.
Titanium: Oxides	1	--		
Tungsten:				
Ore and concentrate	1,249	1,336	963	West Germany 191; Japan 182.
Metal including alloys, all forms value, thousands	--	$4	--	All to Chile.
Zinc:				
Ore and concentrate	694,406	761,749	33,212	Japan 228,055; Belgium-Luxembourg 149,064; France 62,598.
Oxides	378	879	773	West Germany 35; Chile 22.
Metal including alloys:				
Unwrought	151,042	128,808	30,904	Japan 27,131; Venezuela 16,465.
Semimanufactures	4	304	--	Bangladesh 301; Chile 3.
Other:				
Ores and concentrates	2,287	3,508	45	United Kingdom 1,026; Chile 792; Belgium-Luxembourg 583.
Oxides and hydroxides	--	1	--	All to Bolivia.
Ashes and residues	14,657	16,035	--	Belgium-Luxembourg 10,000; Australia 6,000; Canada 35.
Base metals including alloys, all forms	1,906	1,557	432	Netherlands 322; U.S.S.R. 140.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	5	11	--	Bolivia 9; Chile 1; Ecuador 1.
Asbestos, crude	45	30	--	Chile 20; Bolivia 10.
Barite and witherite	57,861	43,291	38,641	Venezuela 3,630; Chile 1,020.
Boron materials:				
Crude natural borates	1,224	3,367	--	Brazil 3,096; Chile 271.
Oxides and acids	269	65	--	Venezuela 62; Ecuador 3.
Cement	4,773	4,760	--	All to Chile.
Clays, crude	249	2,528	--	Do.
Diamond: Gem, not set or strung value, thousands	$5	$3	$1	West Germany $2.
Diatomite and other infusorial earth	10	11	--	All to Chile.
Fertilizer materials:				
Crude, n.e.s	763	2,330	18	Belgium-Luxembourg 2,006; Japan 306.
Manufactured, unspecified and mixed	--	3	--	All to Bolivia.
Graphite, natural	5	34	--	Argentina 28; Chile 6.
Mica: Crude including splittings and waste	--	11	--	All to Chile.
Precious and semiprecious stones other than diamond: Synthetic value, thousands	$1	$2	--	Japan $1; Netherlands $1.
Pyrite, unroasted	56	93	65	West Germany 8; Japan 5.
Sodium compounds, n.e.s.: Sulfate, manufactured	2,693	2,750	273	Brazil 974; Bolivia 716; Venezuela 553.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	2,789	2,373	--	Colombia 2,348; Japan 25.
Worked	44	164	58	Colombia 101; Panama 2.
Dolomite, chiefly refractory-grade	640	190	--	All to Ecuador.
Quartz and quartzite	6	17	9	West Germany 2; Italy 2.
Talc, steatite, soapstone, pyrophyllite	248	--		
Other:				
Crude	(3)	2	--	West Germany 1; Spain 1.
Slag and dross, not metal-bearing	26	115	--	NA.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	7	54	--	All to Chile.
Coal: All grades excluding briquets	150	--		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	Destinations, 1984	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude_ thousand 42-gallon barrels_ _	3,408	4,430	3,985	United Kingdom 445.
Refinery products:				
Gasoline, motor 42-gallon barrels_ _	NA	222,998	222,071	Colombia 485.
Distillate fuel oil _ _ _ _ _do_ _ _ _	NA	230,842	37	Japan 104; Netherlands 7; unspecified 230,694.
Lubricants _ _ _ _ _ _ _ _ _do_ _ _ _	6,013	77	_ _	Ecuador 70; Costa Rica 7.
Residual fuel oil _ _ _ _ _ _do_ _ _ _	2,606,391	1,846,145	1,659,219	Austria 539; Netherlands Antilles 286.
Bituminous mixtures_ _ _do_ _ _ _	164	6	_ _	All to Bolivia.

NA Not available.
[1]Table prepared by H. D. Willis. Export data for 1984 were the latest available at the time of publication.
[2]May include other precious metals.
[3]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1984	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate _ _ _ _ _ _ _ _ _ _ _	5,923	283	_ _	Guyana 278; West Germany 5.
Oxides and hydroxides _ _ _ _ _ _ _ _ _	1,746	1,302	104	West Germany 873; United Kingdom 107.
Metal including alloys:				
Scrap _ _ _ _ value, thousands_ _	$49	_ _		
Unwrought_ _ _ _ _ _ _ _ _ _ _ _ _	3,355	5,289	225	Venezuela 3,993; France 378; Brazil 321.
Semimanufactures _ _ _ _ _ _ _ _ _	1,653	1,918	87	West Germany 526; Brazil 523; France 141.
Beryllium: Metal including alloys, all forms _ _ _ _ _ _ _ value, thousands_ _	_ _	$3	$3	
Chromium:				
Ore and concentrate _ _ _ _ _ _ _ _ _ _ _	1,720	4,144	_ _	Philippines 4,000; Republic of South Africa 139; Denmark 5.
Oxides and hydroxides _ _ _ _ _ _ _ _ _	24	50	(2)	Mexico 21; West Germany 19; Netherlands 5.
Cobalt: Oxides and hydroxides_ _ _ _ _ _ _	3	9	9	
Columbium and tantalum, metal including alloys, all forms, tantalum value, thousands_ _	$1	$1	$1	
Copper: Metal including alloys:				
Unwrought _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	8	6	(2)	Italy 4; Canada 1; West Germany 1.
Semimanufactures_ _ _ _ _ _ _ _ _ _ _	587	820	91	Chile 238; West Germany 204; Brazil 114.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite _ _ _ _ _ _ _ _ _ _ _ _	17	NA		
Metal:				
Scrap _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	77,881	61,328	60,787	Chile 541.
Pig iron, cast iron, related materials_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	225	1,040	140	Trinidad and Tobago 637; Sweden 205.
Ferroalloys:				
Ferromanganese_ _ _ _ _ _ _ _	2,644	1,962	4	France 1,003; Republic of South Africa 561; Netherlands 119.
Unspecified_ _ _ _ _ _ _ _ _ _ _	2,669	2,220	20	Republic of South Africa 867; Chile 776; Belgium-Luxembourg 155.
Steel, primary forms _ _ _ _ _ _ _ _	37	2,326	(2)	Italy 2,311; Brazil 7; Spain 4.
Semimanufactures:				
Bars, rods, angles, shapes, sections_ _ _ _ _ _ _ _ _ _ _ _ _ _	21,013	17,568	623	Japan 5,657; France 3,766; Belgium-Luxembourg 2,522.
Universals, plates, sheets _ _	54,328	55,820	2,591	Japan 24,802; Brazil 12,847; France 8,286.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures —Continued				
Hoop and strip	1,671	2,253	154	Japan 997; Canada 525; West Germany 250.
Rails and accessories	2,332	1,444	371	West Germany 612; United Kingdom 252.
Wire	3,535	1,656	3	Republic of South Africa 1,022; Belgium-Luxembourg 243; Chile 194.
Tubes, pipes, fittings	40,252	8,786	1,267	Argentina 2,228; Japan 2,210; Brazil 1,765.
Castings and forgings, rough	683	760	109	Belgium-Luxembourg 430; Spain 101.
Lead:				
Oxides	11	1	--	All from West Germany.
Metal including alloys:				
Unwrought value, thousands	$4	--		
Semimanufactures	26	3	3	
Magnesium: Metal including alloys:				
Unwrought	16	8	8	
Semimanufactures	11	15	13	Italy 1.
Manganese:				
Ore and concentrate	1,056	1,099	10	Mexico 935; Brazil 152.
Oxides	329	681	17	Mexico 294; Greece 149; Belgium-Luxembourg 74.
Mercury 76-pound flasks	580	783	145	Netherlands 261; China 174.
Molybdenum: Metal including alloys, all forms value, thousands	$18	$26	--	Netherlands $20; Belgium-Luxembourg $5; Brazil $1.
Nickel:				
Ore and concentrate	1	1	--	All from United Kingdom.
Metal including alloys:				
Unwrought	15	171	1	Canada 157; Netherlands 9; Republic of South Africa 5.
Semimanufactures	67	99	12	Netherlands 33; West Germany 26; Austria 12.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, platinum value, thousands	$13	$12	$12	
Rare-earth metals including alloys, all forms	4	NA		
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$34	$24,198	$9,889	Switzerland $14,302; Sweden $6.
Tin:				
Ore and concentrate	--	1	--	NA.
Metal including alloys:				
Unwrought	248	325	35	Bolivia 277; Brazil 13.
Semimanufactures	7	21	2	Bolivia 13; Republic of Korea 2.
Titanium: Oxides	91	129	48	West Germany 49; United Kingdom 17.
Tungsten: Metal including alloys, all forms	11	2	(2)	Mainly from Netherlands.
Zinc:				
Oxides	4	6	1	West Germany 4.
Metal including alloys, semimanufactures	30	9	3	West Germany 3; United Kingdom 3.
Other:				
Ores and concentrates	119	127	--	Australia 125; Republic of South Africa 2.
Oxides and hydroxides	155	72	40	Italy 24; West Germany 6.
Ashes and residues	1	--		
Base metals including alloys, all forms	30	23	6	Bolivia 9; France 2.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	119	189	156	Netherlands 22; West Germany 7.
Artificial: Corundum	253	301	2	Brazil 277; Austria 12; West Germany 10.
Dust and powder of precious and semiprecious stones value, thousands	$7	$2	$2	
Grinding and polishing wheels and stones	89	172	8	Brazil 56; Italy 49; Chile 18.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Asbestos, crude	3,247	6,083	333	Canada 4,479; Greece 980.
Barite and witherite	--	20	1	Brazil 19.
Boron materials: Oxides and acids	38	23	10	Netherlands 10; West Germany 3.
Cement	7,634	5,307	20	Barbados 3,000; Colombia 2,014; France 201.
Clays, crude	7,008	4,429	3,003	United Kingdom 1,025; Japan 111.
Cryolite and chiolite value, thousands	$2	--		
Diamond:				
Gem, not set or strung do.	$11	$2	$1	Brazil $1.
Industrial stones do.	$148	$50	$50	
Diatomite and other infusorial earth	1,850	1,439	390	Mexico 1,029; West Germany 16.
Feldspar, fluorspar, related materials	490	2,515	--	Mexico 2,220; Canada 244; France 48.
Fertilizer materials: Manufactured:				
Ammonia	51	5	--	Argentina 3; Chile 1; West Germany 1.
Nitrogenous	75,554	176,340	36,999	Romania 49,131; U.S.S.R. 31,497.
Phosphatic	13,024	32,431	32,431	
Potassic	23,310	33,111	17,013	U.S.S.R. 8,400; Canada 7,681.
Unspecified and mixed	11,691	29,924	29,627	West Germany 135; Belgium-Luxembourg 97.
Graphite, natural	30	35	25	Japan 9; West Germany 1.
Gypsum and plaster	24	36	25	Japan 9; United Kingdom 2.
Magnesium compounds: Magnesite, crude	4,721	5,007	10	Brazil 3,194; Spain 807; Netherlands 504.
Mica:				
Crude including splittings and waste	123	18	15	West Germany 3.
Worked including agglomerated splittings	7	7	2	Japan 2; Australia 1.
Nitrates, crude	534	162	1	Chile 161.
Phosphates, crude	183	297	96	Belgium-Luxembourg 156; West Germany 45.
Pigments, mineral: Iron oxides and hydroxides, processed	544	648	5	West Germany 626; Brazil 11.
Potassium salts, crude value, thousands	--	$1	--	All from West Germany.
Precious and semiprecious stones other than diamond: Synthetic do.	$1	$2	$2	
Pyrite, unroasted	--	400	400	
Salt and brine	566	363	17	West Germany 264; United Kingdom 61; Netherlands 20.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	20,055	24,087	20,079	West Germany 2,474; France 789.
Sulfate, manufactured	2,864	4,019	117	Chile 1,446; West Germany 964; Uruguay 734.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	140	1,653	61	Greece 967; Italy 292; Spain 234.
Worked	2	--		
Dolomite, chiefly refractory-grade	261	762	--	Spain 756; Sweden 6.
Quartz and quartzite	7	21	3	Belgium-Luxembourg 13; West Germany 6.
Sand other than metal-bearing	6,411	6,320	5,657	Norway 557; West Germany 65.
Sulfur:				
Elemental:				
Crude including native and by-product	4,412	2,784	1,983	Colombia 801.
Colloidal, precipitated, sublimed	94	58	54	West Germany 4.
Sulfuric acid	8	4	--	West Germany 3; France 1.
Talc, steatite, soapstone, pyrophyllite	350	621	50	China 185; Italy 122; Brazil 107.
Other:				
Crude	63	38	5	West Germany 33.
Slag and dross, not metal-bearing	46	4,829	4,829	
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	17	14	13	United Kingdom 1.
Carbon black	236	438	66	France 206; West Germany 104.
Coal:				
Anthracite and bituminous	52,438	26,646	25,352	Colombia 1,002; Australia 292.
Lignite including briquets	233	77	77	
Coke and semicoke	52	91,526	37	Japan 91,317; United Kingdom 63.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	104,400	58	58	
Gasoline do	29,793	20,975	NA	NA.
Mineral jelly and wax do	66,604	78,031	3,172	Brazil 40,263; Argentina 17,440; China 9,688.
Kerosene and jet fuel do	488	258,905	NA	NA.
Distillate fuel oil do	552,040	408,428	163,292	Venezuela 125,276; Mexico 119,860.
Lubricants do	294,280	291,830	46,291	Venezuela 234,640; West Germany 2,639.
Residual fuel oil do	60	20	7	West Germany 13.
Bitumen and other residues do	11,805	121	121	
Bituminous mixtures do	358	297	248	United Kingdom 36; Colombia 6.
Petroleum coke do	160	303	303	

NA Not available.
[1]Table prepared by H. D. Willis. Import data for 1985 were not available at the time of publication.
[2]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Copper.—The large-scale mining sector contributed 93% of the total copper output. SPCC, the largest privately owned copper producer in the country, with operations at the Toquepala and Cuajone Mines in southern Peru, maintained its 61% contribution to Peru's total copper output. Toquepala and Cuajone stopped their operations in 1987 for 20 and 14 days, respectively—compared with 30 and 75 days, respectively, in 1986—both due to labor strikes and supply shortages. The sudden improvement in world copper prices in the last quarter helped SPCC's operations and resulted in a year of changes in Peru. Sharp devaluation of Peru's currency also reduced energy and labor costs. The average refined copper price in 1987 was 81.3 cents per pound compared with 62.1 cents per pound in 1986. SPCC's gross operating income increased to $51 million compared with $21.5 million earned in 1986. SPCC gross sales in 1987 amounted to almost $436 million, and the company paid more than $28.8 million in taxes. In October, the Government extended by 1 year the original period granted to SPCC for recovering the $727 million invested in Cuajone. In this regard, SPCC filed petitions with the Ministry of Energy and Mines and the Ministry of Economy and Finance, requesting a declaration that the end of the Cuajone investment recovery program ended in July 1987. Both Ministries had not acted on these petitions at yearend.

After more than a year of continuous testing, positive results were obtained from dump leaching at the Toquepala Mine. If tests continue to show favorable results and feasibility studies demonstrate that such a project is economic and can be financed, a proposal for an investment in a full-scale solvent extraction project may be presented in 1988.

Centromín Perú continued operating the six deposits containing copper, lead, silver, and zinc at Andaychagua, Casapalca, Cerro de Pasco, Morococha, San Cristobal, and Yauricocha and the deposit at Cobriza. Centromín Perú reported a copper output of 41,900 tons, slightly lower than in 1986. La Oroya copper refinery, also operated by Centromín Perú, produced 53,300 tons of refined copper, which was below its installed operating capacity. During 1987, Centromín Perú suffered production losses of about 10% because of the lack of mining supplies, spare parts, and equipment. Other factors having a direct negative impact on production were the unstable work force, serious transportation limitations,

and a number of terrorist attacks in the Cerro de Pasco area.

Tintaya, the most recently opened state-owned copper mine and the second largest copper producer in Peru, produced almost 167,000 tons of copper concentrates containing 34% copper, a 217% gain over that of 1986. Despite having increased sales of 161%, the company suffered heavy losses, attributable mainly to very high financial costs. Tintaya, as with other state and private mining companies, had to face severe operating restrictions because the CRB limited the availability of foreign currency to import equipment and spare parts. Tintaya also experienced delays in copper concentrate deliveries to customers due to transportation problems.

In 1987, Minero Perú continued its efforts to develop projects that were economically attractive to both the company and the country, such as the 25,000-ton-per-year Ilo copper refinery expansion. The project was 80% completed by yearend and scheduled to be fully operational in August 1988. The plant would have a total expanded production capacity of 175,000 tons of copper cathodes per year. In 1987, the Ilo refinery produced 148,000 tons of copper cathodes, 1.4 million ounces of silver, and 2,800 ounces of gold, maintaining the same level of output as in 1986.

Minero Perú was negotiating with SPCC a new agreement to toll refine part of SPCC's blister copper production at the Ilo refinery. About 55% of the blister copper produced by SPCC went to Minero Perú. Minero Perú's Cerro Verde unit in Arequipa Province produced 6,300 tons of copper concentrates and 24,500 tons of electrolytically refined copper, of which 11,300 tons of the cathodes came from the sulfide leaching process.

A project to treat secondary sulfide ores from the Cerro Verde Mine by combined leaching and flotation was submitted for approval during 1987. The process would use existing facilities to treat the coarse fraction of the ore by acid-ferric bacterial leaching to produce 15,000 tons per year of copper cathodes. The fines would be recovered by flotation in a 5,000-ton-per-day plant to produce 57,000 tons per year of copper concentrates.

The medium-size mining sector's most important copper producers were Minera Pativilca and Minera Condestable. This mining sector contributed 4% of the total production. With the exception of Santa Luisa, owned 100% by Japanese interests, and Nor Perú, owned 80% by ASARCO Incorporated, the rest of the 31 mining companies in this sector are either entirely or largely owned by Peruvians.

Aside from copper deposits currently in production, the country has several unexploited copper deposits waiting development, including Antamina, Coroccohuayco, La Granja, Michiquillay, Canariacu, Toromocho, Tambo Grande, and Quellaveco. All of these deposits are controlled by Minero Perú.

Gold.—Alluvial gold continued to be purchased by the Banco Minero (BM) throughout the country. However, it was estimated that 50% of this production never reached the BM. In previous years, much of the gold produced in the country was thought to have been smuggled to other countries. Currently, this gold was sold directly to jewelers or private individuals because of the weak economy, high inflation, low interest rates, and devaluation of the country's currency. The BM offices at Puerto Maldonado on the Madre de Dios River and in Juliaca, Puno and Cuzco Departments purchased 76,154 ounces of gold, equivalent to 86% of the total alluvial gold purchased by BM in 1987.

Since June 1971, BM had held the monopoly on gold marketing, with the exception of gold exported in concentrates. However, in 1987, it shared this monopoly with the CRB.

In 1987, domestic gold sales amounted to 164,000 ounces, of which 139,000 was sold to the CRB to increase its international reserves. The balance was sold to local jewelers and dentists.

The average international London fixed gold price in 1987 was $446.672 per ounce, 21% higher than the 1986 average.

Most of the alluvial gold produced in Peru was recovered by inefficient labor-intensive methods. Thousands of miners earn their living by panning gold in river banks, mainly in the southeastern slopes of the Andes in the Departments of Madre de Dios and Puno. One company, Cía. Aurífera Rio Inambari S.A., operated a gold dredge on its concession on the Madre de Dios River. The 7-cubic-foot bucket line dredge, which was imported from Bolivia, started dredging on a trial basis in July 1987. During the last 6 months, Inambari produced an average of 514 ounces of gold per month, which was sold entirely to BM. A $6 million loan agreement signed in June 1986 with the International Finance Corp. had not been implemented. The Peruvian Government

had not signed a contract guaranteeing the availability of foreign currency generated by the project to service and repay the loan.

Minero Perú maintained its plans to put the San Antonio de Poto gold dredging project into operation by 1989. The planned investment was $28 million, and the company was authorized by the Government to receive a $5 million loan from the Andean Development Corp. (CAF) to purchase the equipment and spare parts required to start the project at the Pampa Blanca gold deposit in the Ananea area. In 1987, Minero Perú produced 6,816 ounces of gold in the Ananea area of the San Antonio de Poto concession, a 10% increase.

Orcopampa, a subsidiary of Buenaventura, continued to be the largest producer of gold in concentrates in the country and operated a gold and silver mine in the Arequipa Department of southern Peru. The company produced 10,978 tons of concentrates assaying 395.2 ounces of silver per ton, 3.32 ounces of gold per ton, and 4.17% copper. The production was valued at $56 million, compared with $29 million in 1986. Orcopampa's gold production was sold to Centromín Perú, Minpeco, Asarco, Société des Minerais (SGM) of Belgium, and Cominco Ltd. of Canada. The value of Orcopampa's silver production was 67% of the company's total, gold was 33%, copper was 1%, and lead-zinc was less than 1%. Proven and probable ore reserves in 1987 amounted to 2.3 million tons averaging 0.14 ounce of gold per ton and 16.8 ounces of silver per ton.

Lead and Zinc.—Production in 1987 was seriously affected by labor problems and energy supply limitations as a result of terrorist attacks. Production of lead and zinc concentrates dropped by 10% and 18% below those of 1986, respectively.

Centromín Perú continued to be by far Peru's largest lead producer contributing 41% of the country's total lead output. In 1987, Centromín Perú increased lead output by 14% over that of the previous year.

Milpo maintained its leadership among private lead producers, and was also an important zinc and silver producer. In 1987, Milpo produced 22,242 tons of lead concentrates with 86.6 ounces of silver per ton and 69% lead and 41,785 tons of zinc concentrates with 5.3 ounces of silver per ton and 56% zinc.

Centromín Perú and private producers Milpo, Atacocha, Santa Luisa, El Brocal, Huarón, Raura, San Ignacio, Nor Perú, and Chungar were listed among the significant lead producers in Peru in 1987.

Centromín Perú, Peru's major zinc producer, increased its output by almost 12%, offsetting by 10% a decline by San Ignacio, the country's second largest zinc producer and the most important private zinc producer. The San Vicente Mine was paralyzed by a 30-day strike during the last quarter of 1987. Other companies that saw output drop in 1987 were Santa Luisa, Milpo, Raura, and Santander. Increases were registered at Perubar, Atacocha, Volcán, and El Brocal.

Minero Perú's Cajamarquilla zinc refinery suffered a drastic reduction in refined zinc output during 1987, producing only 78,377 tons compared with the previous year's total of 96,045 tons. The reduction was due partly to technical problems at the plant and partly to several power supply cuts caused by terrorist attacks on the Lima electrical network during 1987. The reduction in output forced the company to claim force majeure on its zinc shipments, with the loss estimated at 10,000 tons of zinc production.

The Cajamarquilla zinc refinery also produced 1,618 tons of cement copper, 208 tons of cadmium, and almost 140,000 tons of sulfuric acid, all less than 1986 figures. The company was modifying the refinery to produce cadmium and selenium pigments, zinc and aluminum alloys, as well as float the lead and silver residues and make cement copper from copper sulfate solutions.

Minero Perú continued the exploration of the Izcay Cruz copper-lead deposit in Oyón, Cajatambo Province, north of Lima, where preliminary work was carried out in 1986 by the Instituto Geológico Minero y Metalúrgico del Perú with financial support from the Japan International Cooperation Agency. The exploration work was assigned to Minera Condestable, a Minero Perú subsidiary, which was seeking to extend its activities to production units beyond the underground copper mine it operated near Lima. Ore reserves at the Izcay Cruz polymetallic deposit were estimated at 3.3 million tons averaging 19% zinc, 1.95% lead, and 1.5 ounces of silver per ton.

Silver.—Centromín Perú, Peru's largest silver producer, contributed 24.4% of the country's total output, followed by Buenaventura, Peru's largest silver producer in the private medium-size mining sector, with

8.7%. Orcopampa, 6.6%; Arcata, 6.0%; Huarón, 4.9%; and Nor Perú, SPCC, Caylloma, Milpo, and Santa Luisa, the remaining 49.4%. With the exception of Santa Luisa, all of the companies saw output increases in 1987.

Centromín Perú continued operating seven polymetallic mining units and one mostly copper deposit (see "Copper" section). In addition to copper, lead, silver, and zinc, the polymetallic bodies had minor values of bismuth, cadmium, gold, and tungsten. The production of these mines was treated at eight concentrators operated by the company. The company also operated the Goyllarisquizga coal washing plant, producing 6,440 tons of washed coal that was consumed at the Oroya metallurgical complex. The La Oroya complex refined Centromín Perú's own output of concentrates and that obtained from third parties to produce a total of 22 different metallurgical products.

The most important projects developed during 1987 were the expansion of Centromín Perú's San Expedito concentrator in Cerro de Pasco and the expansion of the Andaychagua Mine to 1,000-ton-per-day capacity. The mine started production on a partial scale in August. Total investment would amount to $43 million, of which $21 million was financed through the Inter-American Development Bank and $17 million from its own resources. When completed, the expansion will increase Centromín Perú's lead production by 2,404 tons per year, zinc by 15,510 tons per year, and silver by 1.2 million ounces per year.

Buenaventura, the largest silver producer in the medium-size mining sector, continued operating its Julcani Mine in Huancavelica and its Uchucchacua Mine near Cerro de Pasco. The two were about 500 kilometers southeast and 270 kilometers northeast of Lima, respectively. The silver content of ore at Julcani increased from less than 10 ounces per ton to more than 13 ounces per ton, while the volume of ore milled decreased. Julcani's production in 1987 was 5,747 tons of lead concentrates averaging 341 ounces of silver per ton. The concentrates averaged 18.3% lead and 13.5% copper. Total production was 1.96 million ounces of silver, 2,259 ounces of gold, 779 tons of copper, and 1,055 tons of lead. Operations at Uchucchacua, begun in 1987, produced 2,836 tons of concentrates valued at $800,000 and averaged 44.9% zinc and 19.7 ounces of silver per ton. In addition, Uchucchacua produced almost 15,000 tons of leached concentrates averaging 13.1% lead and 254 ounces of silver per ton. The leaching yield was 3.43 million ounces of silver and 1,950 tons of lead. The total value of Buenaventura's production in 1987 was $48 million compared with $24.5 million in 1986. The company's production was sold to Asarco, Cominco, MINIMET (France), and SGM (Belgium).

At the Arcata silver mine, 210 kilometers north of Arequipa, production of concentrates increased by 13.2%, while fine metal content of silver dropped by 4.2% due to lower silver content in the ore milled. As a result, Arcata produced 3.8 million ounces of silver and 10,840 ounces of gold.

Société Miniére et Metallurgique de Penarroya S.A. of France reduced its equity in Huarón to 19% and became a minor shareholder. New shareholders included Promotora y Gestadora Minera S.A., an investment society formed by the local Hochschild Cía. Ltda. S.A.; Milpo; and Arcata reduced the company's debt through two capital increases. Huarón is now operated by Administradora de Minas Condoroma (ADMINCO), and the marketing will be handled by the Mauricio Hochschild Group.

Huarón announced plans to invest about $12 million in expanding its polymetallic mine near Cerro de Pasco. The new management plans to expand the plant capacity from 1,200 to 1,800 tons per day and to improve the underground mining operations by introducing a hydraulic fill system and replacing some of the mine equipment. In 1987, Huarón produced concentrates containing 3.2 million ounces of silver and 8,500 tons of lead.

To force an increase in the silver price, which averaged $5.47 in 1986 and in early 1987, the Peruvian Government decided in April to suspend all exports of refined silver and restrict silver hedging operations. By yearend, the CRB started the sale of 25-, 50-, and 100-ounce bars of 995-fine silver. Initially the bank planned to sell about 3 million ounces of silver in bars. More than 350,000 ounces in silver bars was sold the first 2 days, but sales slowed thereafter.

Tin.—Minsur continued operating its San Rafael and Santa Bárbara Mines in Melgar Province, Puno Department. The San Rafaél Mine was the only producer of tin concentrates in Peru. It operated an 800-ton-per-day mill where copper is recovered by flotation and tin by gravimetric and flotation methods. Minsur's production of

copper concentrates is sold to Centromín Perú while tin concentrates are shipped to Tex Tin Corp. in the United States and to RTZ Corp. PLC's Capper Pass smelter in the United Kingdom. In 1987, Minsur produced 11,346 tons of tin concentrate averaging 46.4% tin. By yearend 1987, ore reserves at the San Rafaél deposit amounted to 2.3 million tons.

During 1987, Minsur joined with other private investors to form a new company, Fundicion Peruana de Estaño, which planned to build the first tin smelter in Peru. It would be in Pisco, about 250 kilometers south of Lima, and will create 180 new jobs. Total investment was estimated at $13 million. When completed the smelter would treat about 12,000 tons per year of tin concentrate to produce 4,800 tons per year of refined tin. The feasibility study was completed and the company obtained a $5 million credit from the Government financing development corporation to buy machinery and equipment in the local market. The company was waiting for the Government's approval to start construction at yearend.

Tungsten.—Sociedad Anómima Minera Anonima Regina S.A.'s Mine, 140 kilometers north of Juliaca, was the only tungsten producer in Peru. In 1987, Minera Regina processed 42,558 tons of ore grading 1.56% WO_3 and yielding 412 tons of tungsten concentrates containing 67.3% WO_3. The Regina plant was shut down in August for modifications to improve recovery and increase installed capacity to 67,000 tons per year beginning in February 1988. The Pasto Bueno Mine in Ancash Department owned by Fermín Málaga Santolalla e Hijos Negociación Minera S.A. suspended operations for 1 year, beginning January 1, 1987, owing to the low market price for tungsten and labor problems.

INDUSTRIAL MINERALS

Barite.—Minera Barmine S.A. continued producing barite minerals in its Leonila mining concession at Cocachacra, Huarochiri Province in Lima Department. In 1987, Minera Barmine produced an estimated 10,000 tons of barite for a total value of $102,000. Because its contract with Perubar expired in October 1986, the company exported its entire production of barite, valued at $157,000, to Caribbean countries.

Phosphate.—A delegation from the New Zealand-based company Fletcher Challenge Ltd., came to Peru in late December to negotiate with Minero Perú on the exploration of Area 2 of the Bayovár phosphate deposit. A letter of intent regarding the setting up by Minero Perú and Fletcher Challenge of a joint-venture mining company—Empresa Minera Especial Bayovár—was signed in October 1986 and officially backed by the Peruvian Ministry of Energy and Mines and the New Zealand Ministry of Commerce and Tourism. The proposed development of Area 1 of the deposit in Sechura Province in the northern Department of Piura, would require an investment of about $50 millon. The project would involve the construction of a plant capable of producing 400,000 tons per year of phosphate rock concentrates containing 30% P_2O_5.

Minero Perú has been operating a pilot plant in Area 1 of the Bayovár deposit for many years. The pilot plant originally had a capacity to produce 30,000 tons per year and was expanded to 90,000 tons per year capacity in 1987.

Another company, Empresa Promotora Bayovár (Pro Bayovár) in which Minero Perú holds a 60% interest, had been negotiating for the implementation of a larger scale project for the same deposit. Pro Bayovár had held preliminary talks with the Soviet Union on financing about $50 millon of the cost of the project. The amount of investment capital was the main issue holding up the development, together with doubts whether this project could produce 1.5 million tons per year of phosphate concentrates.

MINERAL FUELS

Coal.—Empresa Promotora de Carbón S.A. (Procarbón), the state-owned company to promote the mining and use of coal throughout the country, continued working on some of its projects. The announcement by the Government that it was negotiating an agreement with Royal Dutch/Shell to exploit the gas deposit found in the southern part of the country focused the country's attention on this new energy resource. Nevertheless, a small pilot coal-briquetting plant was being installed in Huaraz Department with the aid of the U.S. Agency for International Development. It would develop a cheap domestic fuel on which Procarbón had put great hopes as a possible substitute for the subsidized kerosene sold throughout the country. Empresa Siderúrgica del Perú S.A. (Siderperú), the largest state-owned steel company, suc-

cessfully tested the Wellman-Galusha anthracite gasifier installed in its Chimbote Department plant. Minero Perú began development of the Callacuyán anthracite mine in the Alto Chicama Coalfield in the Oyón area. The Callacuyán Mine had been transferred from Minero Perú to Siderperú for exploitation. It had been placed on standby because of Siderperú's economic problems.

Petroleum and Natural Gas.—Crude oil production during 1987 declined to 60 million barrels, a drop of almost 8%. Petroleum refining operations reached the highest level in Peru's history at 93% of the installed capacity. Sales in the domestic market reached an average of 130,500 barrels per day, 11% higher than in 1986, with diesel fuel accounting for almost 26% of the total.

At yearend, Peru's light crude production fell below the volume required by local refineries and an estimated 2 million barrels of crude had to be imported from Ecuador. Imports also included propane gas, diesel No. 2, and kerosene, which were paid for with heavy oil being produced at the jungle fields. In December 1987, Law 24782 was approved making, significant changes in Peru's petroleum law. These changes were intended to encourage new investment in oil-and-gas exploration and production. After a previous year of relatively low international petroleum prices, there was a small increase in 1987. Peru, however, was unable to benefit as Peruvian crude production continued its downward trend, and the volume of heavy crude produced increased relative to total production. This forced Peru to stop crude exports and to resume oil imports for the first time since 1974. Imports of petroleum products increased more than 166% above those of 1986, and exports, primarily exports, primarily products, decreased 17% below that of 1986 in volume. The average price per barrel of crude oil obtained by Petroperú increased from $11.32 in 1986 to $15.77 in 1987. As a result, the trade balance between oil exports and imports in 1987 was favorable by approximately $134 million. No new oil contracts were signed during the year. The only contract negotiated was the agreement on the development of a large gasfield in the jungle, with Shell, which was to be signed in March 1988.

Oil reserves continued to fall and by yearend had reached 457 million barrels, underlining Peru's urgent need for an aggressive exploration program. However, Petroperú did not have the necessary funds. Several foreign companies, including Mobil Oil Corp., Union Oil Co. of California, and British Petroleum Corp., had shown interest in oil exploration investments, particularly in view of new incentives granted to foreign investors late in the year, but the Government economic policies continue to create concern. In addition, Enron Corp. had not been recompensated for its nationalized Belco properties, and Shell's gas-contract negotiations had become highly politicized.

Shell and Petroperú reached preliminary agreement on developing the new gas deposit in the center of Peru east of Lima. The final contract was to be signed by August 31, 1988, and commit Shell to invest almost $1.3 billion to produce natural gas for domestic consumption and export. The contract also would permit Shell to continue oil exploration. This was the first agreement reached under Peru's liberalized oil-investment laws. Shell had already invested about $200 million in seismic and exploratory drilling in Blocks 38 and 42, which encompass about 2 million hectares in this area, under a 1981 oil-exploration contract that expired during 1987. Although Shell failed to find oil, it did discover an estimated 12 trillion cubic feet of natural gas and 650 million barrels of natural gas liquids and condensate in the San Martin-Sega Kiato and Cashiriari-Armihuari structures near the town of Camisea in the Department of Cuzco.

Occidental Petroleum Corp. finished drilling the last of eight holes programmed in Block 1-AB in the northeastern jungle of Peru under the contract signed with Petroperú in March 1986. None of the wells was successful. The Jibarito oil well had produced 100 barrels per day of heavy oil (10°). Meanwhile Occidental was preparing to start drilling its first exploration well in Block 36, in the central jungle.

Uranium.—The Instituto Peruano de Energía Nuclear (IPEN) has resumed prospecting work on the Macusani uranium field in Carabaya Province, Puno Department, in an effort to complete the exploration program and invite development bids. IPEN claimed to have demonstrated the presence of 3,500 tons of uranium ore near the surface in Chapi, one of the six deposits of Macusani. A prefeasibility study was expected to take another year, after which a full feasibility study would be undertaken. The development phase would require an investment of about $80 million over 4 years.

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The Mineral Industry of the Philippines

By Travis Q. Lyday[1]

After 3 consecutive years in which the nation's economy had a negative growth greater than 9%, the country's real gross domestic product (GDP) increased by an estimated 5.7% more than that of 1986, to $33.5 billion.[2] The mining industry continued to grow, spurred by favorable international prices for copper and gold as well as improved demand for construction-related industrial minerals, and represented an estimated 2% of the GDP.

The Philippines is rich in mineral resources. There are profuse deposits of gold, especially in Mountain and Camarines Norte Provinces on Luzon; copper in Zambales Province on Luzon and in the Visayan Islands; zinc at Zamboanga on Mindanao; high-grade chromium in Zambales and Camarines Sur Provinces on Luzon, near Surigao on Mindanao, and near Puerto Princesa on Palawan; and nickel at Hinatuan, Surigao del Norte Province on Mindanao. Deposits of cadmium, iron ore, lead, manganese, mercury, molybdenum, and silver also occur in the country. Deposits of industrial minerals include limestone for cement on Cebu, Luzon, and Romblon; salt and asbestos on Luzon; marble on Romblon and Panay; asphalt on Leyte; gypsum on Luzon; sulfur on Luzon, Leyte, and Mindanao; phosphate rock on Cebu and Bohol; and coal on Cebu and Palawan.

Government Policies and Programs.—Envisioning the importance of the role of mineral resources and the mineral industry to economic recovery and sustained growth of the country, the Government formulated a medium-term (5-year) mineral resources development plan for 1987-91. The plan, primarily developed by the Department of Environment, Energy and Natural Resources (DEENR), formerly the Department of Natural Resources, and its Mines and Geo-Sciences Bureau, formerly named the Bureau of Mines and Geo-Sciences, had several aims. They included promoting the efficient and judicial use of mineral resources; ensuring sustainable productive capacity of mineral resources; encouraging and supporting community-based (i.e., small-scale) mining, mineral resource management and conservation; achieving a more equitable sharing of benefits derived from the development of mineral resources; increasing the mineral sector's contributions toward the national effort directed toward poverty; and encouraging the use of modern mining technology to promote harmony with the environment.

The Government, through the DEENR and the Chamber of Mines of the Philippines, requested a United Nations consultant to advise on the drafting of a new mining code. Work on the new code was scheduled to begin in January 1988.

PRODUCTION

According to the National Economic and Development Authority, the total value of mining output in the Philippines increased 13.6% in the first half of 1987 more than the same 1986 period, rising to about $290 million. Nearly 75% of the total mining output was accounted for by copper and gold, valued at about $211 million. The

value of mined gold, $128 million, increased 27%, almost entirely owing to a 24% rise in the average price of gold, while that of copper decreased 9% to about $83 million. The value of chromium production was about $94 million, a decrease of about 25%.

Except for chemical- and refractory-grade chromite, production of the major minerals in the Philippines continued to decline.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Arsenic: White (equivalent of arsenic acid)[e]	--	--	5,000	5,000	5,000
Chromium: Chromite, gross weight:					
Metallurgical-grade	136,347	123,015	122,359	85,271	[3]69,429
Chemical-grade	--	5,369	15,038	16,109	[3]19,899
Refractory-grade	130,562	132,505	134,634	72,850	[3]98,572
Total	266,909	260,889	272,031	174,230	187,900
Cobalt, mine output, Co content	165	64	911	92	--
Copper:					
Mine output, Cu content	271,403	233,359	222,189	222,644	[3]215,014
Metal:					
Smelter	57,600	109,200	133,800	124,300	[3]124,700
Refined	38,800	99,230	130,227	134,547	[3]132,118
Gold, mine output, Au content troy ounces	816,536	827,149	1,062,149	1,296,367	[3]1,352,934
Iron and steel:					
Iron ore and concentrate thousand tons	3	--	--	--	--
Ferroalloys:					
Electric-furnace ferrosilicon[e]	20,000	18,400	20,000	20,000	--
Electric-furnace ferrochromium	26,901	48,049	50,815	[e]55,000	50,000
Steel, crude thousand tons	200	250	250	250	250
Manganese ore and concentrate, gross weight	2,242	615	387	232	[3]421
Molybdenum, mine output, Mo content	40	--	--	--	--
Nickel:					
Mine output, Ni content	13,900	13,601	28,158	12,790	[3]7,818
Metal, smelter	6,097	3,528	16,993	2,076	--
Silver, mine output, Ag content thousand troy ounces	1,823	1,574	1,685	1,688	[3]1,654
Zinc, mine output, Zn content	2,275	2,189	1,880	1,573	[3]1,129
INDUSTRIAL MINERALS					
Barite	1,201	581	--	--	--
Cement, hydraulic thousand tons	4,383	3,651	3,080	3,457	3,000
Clays:					
Bentonite	670	38,249	24,971	[e]20,000	[3]759
Red	532	200	--	[e]300	300
White	19,990	8,618	6,093	[e]7,000	7,000
Other	397,903	372,111	344,921	[e]350,000	[3]406,033
Feldspar	6,524	11,486	5,412	[e]6,000	6,000
Gypsum and anhydrite:					
Natural	500	600	300	[e]200	500
Synthetic[e]	110,000	112,000	112,000	112,000	112,000
Lime	50,675	50,711	47,427	[e]45,000	45,000
Magnesite	620	625	676	[e]650	650
Nitrogen: N content of ammonia	20,300	16,200	[e]17,000	[e]17,000	17,000
Perlite	2,020	15,641	3,883	[e]3,500	4,000
Phosphate:					
Guano	610	552	1,229	[e]1,000	1,000
Phosphate rock	4,135	7,488	6,392	[e]6,000	8,000
Pyrite and pyrrhotite (including cuprous), gross weight	62,864	82,806	232,478	244,028	[3]341,417
Salt, marine	381,912	401,008	421,058	785,354	[3]446,532
Sand and gravel:					
Silica sand thousand tons	408	432	317	[e]400	[3]351
Other[4] thousand cubic meters	15,132	14,695	11,235	[e]13,000	[3]13,943
Stone:					
Dacite	32,448	--	--	--	--
Diorite	47,895	--	--	--	--
Dolomite	336,043	368,052	362,101	[e]360,000	360,000
Limestone[5] thousand tons	6,686	4,074	3,521	[e]4,000	4,000
Marble (dimension), unfinished cubic meters	6,117	4,919	4,010	[e]5,000	5,000
Volcanic cinder do.	482	--	6,630	[e]1,000	1,000
Sandstone	47,234	5,340	--	--	--
Tuff	117,772	29,269	19,505	[e]20,000	--
Quartz	74,515	79,536	93,735	[e]80,000	80,000
Crushed, broken, other[6] thousand cubic meters	1,857	600	701	[e]1,000	1,000
Sulfur: S content of pyrite	29,232	38,505	108,102	113,473	158,200
Talc	878	927	345	[e]1,000	--

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS					
Coal, all grades	1,019,594	1,216,388	1,257,881	1,128,449	[3]1,152,342
Petroleum:					
Crude thousand 42-gallon barrels	4,654	3,890	3,285	2,190	1,800
Refinery products:					
Gasoline do	9,349	8,124	[e]9,000	[e]9,200	9,000
Jet fuel do	3,007	3,322	[e]3,000	[e]3,000	3,000
Kerosene do	3,441	2,382	[e]2,500	[e]2,700	2,500
Distillate fuel oil do	17,540	17,027	[e]17,000	[e]17,300	17,000
Residual fuel oil do	21,670	18,544	[e]19,000	[e]20,000	19,000
Other do	5,097	4,027	[e]4,500	[e]4,800	4,500
Refinery fuel and losses do	14,555	[e]15,000	[e]15,000	[e]15,000	15,000
Total do	74,659	[e]68,426	[e]70,000	[e]72,000	70,000

[e]Estimated. [p]Preliminary.

[1]Table includes data available through July 12, 1988.

[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 figures are as follows, in cubic meters: 1983—84,742; 1984—17,722; 1985—1,914; 1986—not available; and 1987—not available.

[6]Includes materials described as rock, crushed or broken; stones, cobbles, and boulders; rock aggregates; and broken adobe.

TRADE

Minerals were among the Philippines top exports in 1987, and the mining industry was a major foreign-exchange earner. The country's mineral exports in 1987 were valued at $769 million, 2.6% more than the 1986 total, and represented about 15% of the country's total exports. The increase was primarily due to higher world metal prices. However, export volumes of major metals fell. The share of copper concentrate exports to total exports continued to decline as the Philippine Associated Smelting and Refining Corp. (PASAR) continued to take, by Government mandate, a larger share of the domestic copper production for in-country smelting. Shipments of copper concentrates dropped to 332,000 tons from 361,000 tons and copper cathodes to 105,000 tons from 127,000 tons. Gold shipments decreased to almost 1.08 million troy ounces from about 1.13 million troy ounces, and silver to 1.48 million troy ounces from 1.57 million troy ounces.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys, all forms	28	56	(2)	Japan 31; Australia 10.
Arsenic: Oxides and acids	1,449	2,613	1,319	United Kingdom 867; Australia 331.
Chromium: Ore and concentrate	159,435	130,165	26,213	Sweden 25,756; China 21,471.
Copper:				
Ore and concentrate	344,201	359,781	--	Japan 285,584; Republic of Korea 24,964.
Matte and speiss including cement copper	7,004	--		
Metal including alloys:				
Scrap	6,915	8,151	--	Singapore 5,000; Japan 1,354.
Unwrought	129,901	130,228	--	Japan 41,072; Taiwan 38,320; Republic of Korea 28,840.
Semimanufactures	2,797	5,235	--	Taiwan 2,347; Singapore 1,286; Japan 806.
Gold: Metal contained in copper concentrates troy ounces	[r]332,374	394,572	--	Japan 178,686; United Kingdom 62,975; France 62,492.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite:				
Agglomerated thousand tons	4,022	3,587	115	Japan 3,472.
Not agglomerated	12,000	16,552	--	All to Japan.
Pyrite, roasted	11,751	7,917	--	Taiwan 4,300; Japan 3,617.
Metal:				
Scrap	952	849	19	Japan 784.
Ferroalloys:				
Ferrosilicon	22,428	10,079	--	Japan 7,101; Indonesia 1,004; Taiwan 876.
Unspecified	50,379	55,970	--	Japan 40,745; Netherlands 4,200.
Steel, primary forms	10	--		
Semimanufactures:				
Bars, rods, angles, shapes, sections	84	110	61	Sri Lanka 12.
Universals, plates, sheets	118	16	--	Guam 6; China 4.
Hoop and strip	(2)	--		
Wire	1	7	--	All to Pacific Islands Trust Territory.
Tubes, pipes, fittings	3,249	525	351	Australia 50; Singapore 49.
Castings and forgings, rough	497	408	151	Australia 214.
Magnesium: Metal including alloys, all forms	19	20		All to Japan.
Manganese: Ore and concentrate	--	216	--	Do.
Nickel:				
Ore and concentrate	616,455	420,809	--	Do.
Metal including alloys:				
Unwrought	11,284	2,566	300	Switzerland 950; Republic of Korea 612; Japan 389.
Semimanufactures	2,652	1,604	300	Japan 1,260.
Silver: Metal including alloys, unwrought and partly wrought troy ounces	r497,566	708,034	13,125	France 248,154; United Kingdom 240,684; West Germany 162,268.
Tin: Metal including alloys, all forms	21	15	4	Japan 11.
Tungsten: Metal including alloys, all forms	2	4	4	
Zinc:				
Ore and concentrate	4,487	3,404	--	All to Japan.
Metal including alloys, all forms	r188	304	--	Taiwan 196; Japan 108.
Other:				
Oxides and hydroxides	77	109	10	Netherlands 64; United Kingdom 16.
Ashes and residues	8,488	8,467	--	Singapore 6,082; Japan 1,547.
Base metals including alloys, all forms	693	688	154	Japan 255; Hong Kong 103; Taiwan 93.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Natural: Corundum, emery, pumice, etc	101	634	--	Hong Kong 313; Taiwan 301.
Asbestos, crude	--	360	--	Indonesia 300; Pakistan 60.
Cement	370,828	105,366	--	Bangladesh 73,762; China 30,000.
Clays, crude	40,901	10	--	All to Sri Lanka.
Feldspar, fluorspar, related materials	536	--		
Fertilizer materials:				
Crude, n.e.s	1,627	1,173	--	Taiwan 896; West Germany 242.
Manufactured:				
Nitrogenous	3,170	13,790	--	Australia 6,568; Thailand 2,947; Indonesia 2,558.
Phosphatic	158,304	544,503	--	China 243,564; Iran 110,411; Ethiopia 76,326.
Unspecified and mixed	31,004	30,614	--	China 30,577.
Gypsum and plaster	--	5,250	--	All to Japan.
Lime	--	12	--	All to Guam.
Mica: Crude including splittings and waste kilograms	--	500	--	All to Indonesia.
Phosphates, crude	--	600	--	All to Taiwan.
Pigments, mineral: Natural, crude	3	1	--	All to Guam.
Salt and brine	(2)	1	1	
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	4,161	4,094	--	Japan 3,141; Taiwan 622.
Worked	3,345	2,136	614	Australia 398; Guam 323; Hong Kong 311.
Dolomite, chiefly refractory-grade	327,230	271,247	--	All to Japan.
Gravel and crushed rock	12,668	15,114	14	Japan 10,996; Hong Kong 3,069.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel —Continued				
Limestone other than dimension	3,750	39,954	--	Taiwan 21,759; Japan 13,745.
Sand other than metal-bearing	2,113	2,668	795	Japan 601; Hong Kong 420; United Kingdom 316.
Sulfur:				
Elemental: Colloidal, precipitated, sublimed kilograms	--	20	--	All to Thailand.
Sulfuric acid	20,214	--		
Other:				
Crude	233	2,198	--	Taiwan 1,841.
Slag and dross, not metal-bearing	1,222	480	--	All to Japan.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	18	18	--	All to Hong Kong.
Carbon black	1,372	1,477	--	Thailand 986; Taiwan 398.
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	655,504	868,457	--	Hong Kong 612,190; Malaysia 98,588; Thailand 67,535.
Naphtha including white spirit do	580,644	1,864,314	--	Japan 899,402; Taiwan 456,204.
Kerosene and jet fuel do	--	335,593	--	All to Japan.
Lubricants do	10,333	9,999	--	Taiwan 4,512; Republic of Korea 2,362.
Residuel fuel oil do	--	441,611	--	Hong Kong 227,845; Guam 213,699.

[r]Revised.
[1]Table prepared by Audrey D. Wilkes.
[2]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals kilograms	3,463	1,812	--	United Kingdom 995; Japan 765.
Aluminum:				
Ore and concentrate	5,005	5,379	39	Malaysia 4,861; China 400.
Oxides and hydroxides	3,532	5,380	108	Japan 4,084; Australia 630.
Metal including alloys:				
Scrap	144	345	58	Hong Kong 270.
Unwrought	4,881	6,271	38	Australia 3,754; Canada 1,328.
Semimanufactures	6,419	6,445	123	Japan 1,795; Republic of Korea 1,040; Singapore 905.
Arsenic: Oxides and acids	14	16	--	All from Malaysia.
Chromium:				
Ore and concentrate	29,947	17	--	Japan 12.
Oxides and hydroxides	76	27	18	West Germany 7.
Cobalt: Oxides and hydroxides kilograms	4,750	1,231	45	Belgium-Luxembourg 500; Canada 400.
Copper:				
Sulfate	95	245	--	Taiwan 167; West Germany 49.
Metal including alloys:				
Scrap	--	16	--	All from Japan.
Unwrought	5	8	--	Mainly from Japan.
Semimanufactures	2,615	3,241	324	Japan 1,687; Republic of Korea 422.
Gold: Metal including alloys, unwrought and partly wrought troy ounces	8,583	9,571	6,244	Singapore 1,853.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite, not agglomerated thousand tons	[r]3,389	2,575	--	Brazil 1,157; Australia 1,057.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal:				
Scrap	751	85,243	38,878	United Kingdom 20,553; Canada 19,826.
Pig iron, cast iron, related materials	329	22,366	24	Malaysia 21,989.
Ferroalloys:				
Ferromanganese	591	1,431	22	Netherlands 324; Mozambique 260; Taiwan 210.
Unspecified	68	292	3	Japan 77; China 50; Taiwan 40.
Steel, primary forms	238,542	391,367	1,643	Brazil 150,040; Republic of Korea 119,389.
Semimanufactures:				
Bars, rods, angles, shapes, sections	35,944	37,685	184	Japan 22,581; Republic of Korea 9,625.
Universals, plates, sheets	97,058	199,923	8,813	Japan 156,469.
Hoop and strip	4,403	4,495	94	Japan 3,854.
Rails and accessories	1,301	384	5	Japan 174; Republic of Korea 123.
Wire	5,981	7,128	63	Japan 3,541; Republic of Korea 2,334.
Tubes, pipes, fittings	13,518	12,445	418	Japan 8,453; Republic of Korea 2,008.
Lead:				
Oxides	12	12	5	Australia 5.
Metal including alloys:				
Scrap	3,600	4,307	39	Australia 4,116.
Unwrought	2,984	4,532	68	Australia 1,806; Taiwan 1,506; Japan 1,078.
Semimanufactures	189	197	52	Australia 89; Japan 27.
Magnesium: Metal including alloys, all forms	69	36	1	Hong Kong 28.
Manganese:				
Ore and concentrate, metallurgical-grade	2,669	3,040	--	Singapore 2,159; Japan 799.
Oxides	916	874	11	Japan 756; Australia 80.
Mercury 76-pound flasks	886	1,596	(2)	Algeria 490; China 429; West Germany 300.
Molybdenum: Metal including alloys, all forms	20	2	1	Netherlands 1.
Nickel: Metal including alloys:				
Unwrought	28	50	10	Japan 19; Hong Kong 13.
Semimanufactures	160	68	5	West Germany 24; Austria 12; Japan 11.
Platinum-group metals: Metals including alloys, unwrought and partly wrought troy ounces	801	387	386	West Germany 1.
Silver: Metal including alloys, unwrought and partly wrought do	1,291	885	810	United Kingdom 75.
Tin:				
Oxides kilograms	95	--		
Metal including alloys, all forms	362	527	(2)	Indonesia 409.
Titanium:				
Ore and concentrate	487	966	--	Australia 802; Mozambique 108.
Oxides	794	1,505	24	Japan 544; United Kingdom 461.
Tungsten: Metal including alloys, all forms	11	8	(2)	Belgium-Luxembourg 7.
Uranium and/or thorium: Oxides and other compounds kilograms	500	--		
Zinc:				
Oxides	399	379	56	Taiwan 129; Republic of Korea 64.
Blue powder	189	168	143	Australia 15.
Metal including alloys:				
Unwrought	13,000	18,897	102	Japan 5,452; Australia 5,061; Canada 3,461.
Semimanufactures	31	27	18	Hong Kong 6.
Zirconium: Ore and concentrate	22	41	--	Mainly from Australia.
Other:				
Ores and concentrates	--	7	7	
Oxides and hydroxides	4,135	5,386	--	China 3,558; United Kingdom 721.
Ashes and residues	79,791	38,535	76	Japan 38,422.
Base metals including alloys, all forms	35	30	10	China 16.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	338	244	23	Chile 90; Netherlands 64; Hong Kong 51.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Abrasives, n.e.s. —Continued				
Artificial:				
Corundum	27	63	--	Australia 54.
Silicon carbide	126	51	3	West Germany 18; Brazil 17.
Dust and powder of precious and semi-precious stones including diamond grams	440	150	--	All from Austria.
Grinding and polishing wheels and stones	520	788	8	Hong Kong 291; Taiwan 107; China 80.
Asbestos, crude	1,190	1,151	305	Canada 726; U.S.S.R. 102.
Barite and witherite	1,247	43	21	China 20.
Boron materials: Oxides and acids	124	174	72	Italy 36; France 34.
Bromine including fluorine and iodine	4	4	(2)	West Germany 2.
Cement	736	14,033	773	Republic of Korea 11,249; China 1,500.
Chalk	31	24	--	West Germany 22.
Clays, crude	19,924	19,291	6,963	Thailand 2,136; Hong Kong 1,790; Malaysia 1,582.
Cryolite and chiolite kilograms	--	500	--	All from Switzerland.
Diamond: Industrial stones, natural carats	178,802	1,067,311	--	Belgium-Luxembourg 1,062,711.
Diatomite and other infusorial earth	148	407	143	Japan 224.
Feldspar, fluorspar, related materials	1,633	1,535	31	Thailand 500; China 354; Japan 183.
Fertilizer materials:				
Crude, n.e.s	--	12	12	
Manufactured:				
Ammonia	184,311	139,254	1,018	Indonesia 83,058; Qatar 15,941.
Nitrogenous	377,141	720,402	3	Indonesia 297,430; Japan 111,626; Kuwait 81,654.
Phosphatic	4,196	760	--	All from West Germany.
Potassic	58,268	86,590	4	Canada 22,000; Republic of Korea 14,901; Israel 11,000.
Unspecified and mixed	206,909	52,860	20	Republic of Korea 51,400.
Graphite, natural	73	122	1	Sri Lanka 40; China 24; Hong Kong 20.
Gypsum and plaster	130,627	150,984	162	Indonesia 70,542; Thailand 16,070.
Lime	330	431	386	United Kingdom 45.
Magnesium compounds: Magnesite, crude including calcined	5,651	8,375	36	China 5,046; Japan 2,769.
Mica, all forms	31	112	40	West Germany 36; India 20.
Nitrates, crude	--	74	--	All from Belgium-Luxembourg.
Phosphates, crude thousand tons	306	1,287	97	Nauru 714; Morocco 383; Senegal 84.
Pigments, mineral:				
Natural, crude	1,843	3,106	83	India 2,789.
Iron oxides and hydroxides, processed	696	871	68	West Germany 603; Spain 97.
Salt and brine	71,130	88,917	124	Australia 44,454; China 37,411; West Germany 5,311.
Sodium compounds, n.e.s.:				
Carbonate, natural and manufactured	66,833	71,229	37,152	Kenya 18,162; Japan 14,914.
Sulfate, manufactured	9,519	14,730	36	China 10,299; Taiwan 3,193.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	105	154	--	Hong Kong 84; Taiwan 46; China 24.
Worked	(2)	16	--	Italy 15.
Dolomite, chiefly refractory-grade	2,455	1,271	--	United Kingdom 973; West Germany 135; Taiwan 122.
Gravel and crushed rock	617	214	1	France 174; Japan 34.
Limestone other than dimension	229	1,695	--	Taiwan 1,500.
Quartz and quartzite	43	2	--	All from Netherlands.
Sand other than metal-bearing	5,357	11,689	85	Australia 11,109; Taiwan 460.
Sulfur:				
Elemental:				
Crude including native and by-product	309	2,015	130	Thailand 872; China 300; Japan 278.
Colloidal, precipitated, sublimed	20,382	17,318	5,236	Canada 6,247; Singapore 4,369.
Dioxides	1	1	--	All from Netherlands.
Sulfuric acid	30,392	123,407	(3)	Japan 123,373.
Talc, steatite, soapstone, pyrophyllite	5,620	7,147	694	Republic of Korea 3,802; China 1,135.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Other:				
Crude	257	359	1	Japan 192; Australia 164.
Slag and dross, not metal-bearing	54,357	80,017	1	India 63,344; Taiwan 11,160; Japan 5,511.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	98	50	--	Republic of Korea 34; Singapore 16.
Carbon black	14,306	764	85	Taiwan 233; Singapore 201.
Coal, all grades including briquets	1,152,747	960,308	58	Australia 682,644; Indonesia 92,267; U.S.S.R. 67,325.
Coke and semicoke	86,926	85,134	7,018	Japan 63,293; U.S.S.R. 14,300.
Petroleum:				
Crude, thousand 42-gallon barrels	r47,114	49,391	--	Saudi Arabia 13,100; Malaysia 9,936; Kuwait 6,797.
Refinery products:				
Gasoline, do.	26	25	(2)	Mainly from Australia.
Mineral jelly and wax, do.	57	54	5	China 36.
Distillate fuel oil, do.	4,459	6,285	312	Taiwan 1,568; Republic of Korea 1,445; Singapore 1,422.
Lubricants, do.	51	46	9	West Germany 9; Singapore 7.
Residual fuel oil, do.	38	13	(2)	Mainly from Singapore.

rRevised.
[1]Table prepared by Audrey D. Wilkes.
[2]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Chromium.—The chromium industry in the Philippines continued to stabilize during 1987, although ore production was estimated to have remained about the same as in 1986. Ore buyers remained uneasy, however, over the nation's long-range supply capability of chromium. Mines were being depleted while no new reserves were being developed and no new investments were being made.

The Philippines produced chemical-, metallurgical-, and refractory-grade chromite and ranked as the world's sixth largest producer. The largest producer of metallurgical-grade chromite, Acoje Mining Co. Inc. at Santa Cruz on Luzon Island, was faltering at yearend with heavy losses and unpaid loans. Voest-Alpine AG of Austria, the company's major shareholder, sold its holdings to Independent Resources of Australia, Minimax Exploration Co., and to private interests late in the year. Benguet Corp. was the largest miner of refractory-grade chromite, producing from its Masinloc Mine, Zambales Province, Luzon Island. Alamag Processing Corp., a joint venture of Rio Chico Mining Corp. of the Philippines and Bayer AG of the Federal Republic of Germany, produced chemical-grade chromite from its mines in eastern Samar Province.

Ferrochrome Philippines Inc. (FPI) was the largest producer of ferrochromium in the Philippines, operating the 60,000-ton-per-year-capacity plant at Togoloan, near Cagayan de Oro, in northern Mindanao. Downtime for relining the sintering kiln and repairing a broken electrode resulted in an estimated production of 47,000 tons of high-carbon ferrochromium, lower than in previous years. Pacific Chrome Inc. held an option to take over Electro Alloys Inc. at Iligan City, Mindanao, to produce ferrochromium. A drawback to the takeover was that the Philippines could not supply the raw materials for the production of the target

18,000 tons of ferrochromium per year. Alternative sources were being considered at yearend, including India, Madagascar, New Caledonia, and the Republic of South Africa.

Copper.—PASAR—which was owned by the state-owned National Development Corp., 40%; a Japanese consortium led by Marubeni Corp., 32%; local copper producers led by Atlas Consolidated Mining and Development Corp., 23%; and International Finance Corp., 5%—was planning to increase production by 25% at its 138,000-ton-per-year smelter at Isabel in the central Province of Leyte. This increased output would lower unit production costs, take advantage of the shortfall of refined copper during the year, and diversify the company's sources of copper concentrates. Cost of the expansion was estimated to be $51 million. PASAR would have to import copper concentrate, since local mining firms had contract commitments with Japanese and other foreign smelters. The new smelter would require about 480,000 tons of copper concentrate when operating at full capacity.

At midyear, PASAR tested the feasibility of importing 50,000 tons of copper concentrate per year from Papua New Guinea. In June, DEENR gave approval to import 40,000 tons of concentrates from Papua New Guinea for the balance of 1987, marking the Philippines first imports of copper concentrates. At yearend, the company received approval to import 120,000 tons from Papua New Guinea in 1988. Sufficient concentrate from Papua New Guinea's two copper mines, Ok Tedi and Bougainville, would bring PASAR's capacity utilization to 98.5% compared with only 57% that could be supplied from existing Philippine mines.

The PASAR smelter was reportedly shut down for about a week in March owing to power problems, and some delay in cathode shipments was experienced. According to one report, some customers of PASAR were refusing shipments of copper cathode because of a quality-control problem.[3]

Galactic Resources Ltd. of Canada and Lepanto Consolidated Mining Co. Inc. announced near yearend a 40-60 joint venture to develop a major copper-gold mine, the Far South East Deposit, at Mankayan in Benguet Province. (See the "Gold" section for additional information.) Drilling by Lepanto Consolidated outlined 292 million tons of ore containing about 2 million tons of copper. J. S. Redpath Corp. of the United States and Kilborn Engineering Ltd. of Canada were to complete a feasibility study in early 1988.

Bond Corp. Holdings Ltd. of Australia and Atlas Consolidated, the Philippines largest mining firm, continued negotiations during the year on an agreement by Bond to assume Atlas Consolidated's existing loans and their restructuring into a gold loan; to acquire a 40% equity in Atlas Consolidated; and to extend a loan to Atlas Consolidated for the exploration and development of the Masbate gold mine on Masbate Island. By yearend, Atlas Consolidated's creditors had agreed in principle that Bond should assume Atlas Consolidated's debts. However, repayment was to be in gold rather than dividends, thereby creating an additional problem for the discussions. Under Philippine law, gold produced in the Philippines must be declared and sold to the Central Bank of the Philippines.

The Philippines ranked 10th among world copper producers. According to the Chamber of Mines of the Philippines, production of copper, by company, was as follows in metric tons:[4]

Company	1986	1987
Atlas Consolidated Mining and Development Corp	69,660	81,049
Maricalum Mining Corp	42,210	40,606
Marcopper Mining Corp	28,851	23,933
Philex Mining Corp	27,482	23,618
Benguet Corp	23,151	19,153
North Davao Mining Corp	16,863	13,671
Lepanto Consolidated Mining Co. Inc	13,011	12,985
Benguet Exploration Inc.[1]	1,416	--
Total	222,644	215,015

[1]Copper production from the Copper Shield project was shut down in Sept. 1986.

Gold.—The Far South East Deposit, a major copper-gold porphyry deposit has indicated reserves, as developed by exploratory diamond drilling, of 12 million troy ounces of gold and an equal quantity of recoverable silver. (See the "Copper" section for additional information.) Galactic Resources was to contribute $2.4 million as part of the initial capitalization to fund a feasibility study. The total cost of the project was estimated to be $180 million.

Cultus Gold NL was making a surface exploration on its claims at Paracale Nationale in Bicol Province at yearend. The properties contain a former producing mine, and the company was resampling and

retrenching to determine both underground reserves and reserves amenable to surface mining. Cultus was also sampling and mapping three other properties in the area.

Kenmare Resources Pty. Ltd. Co. of Ireland initiated a major exploration program for epithermal gold on the islands of Leyte, Luzon, and Negros in September. The program, including geochemical assays on stream sediment and bedrock samples and heavy-mineral panning, was in joint venture with the Philippine National Oil Corp. (PNOC), each with a 40% stake, and private investors (20%). In addition, Kenmare was investigating in its own right two other prospects: Mount Bagacay, a prominent volcano near the southern edge of the Paracale gold district in Camarines Norte, and Mount Sembrano, a volcanic zone 40 kilometers east of Manila containing old gold workings.

Paragon Resources Ltd. acquired a 40% interest in the Longos Mine, formerly known as the Philippine Eagle Mine, in the Paracale District at the beginning of 1987. Private interests, who purchased the mine in the early 1980's and developed the property for production in 1982, held the remaining interest. Initial production, expected to begin at yearend, was projected at about 37,800 troy ounces of gold per year. Ore reserves were 1.8 million tons grading 0.28 troy ounce of gold per ton. Assets at the mine included head frames and winders, mining and milling equipment, and a concentrator and cyanide plant with a capacity to treat 15,000 tons of ore per year. Apparently, except for dewatering, the mine was virtually ready to produce as soon as agreements between the partners could be finalized. However, Paragon was conducting further exploration work and refurbishing the mill to produce at the rate of 150,000 tons of ore per year. The Philippine Eagle closed in 1952 because of low gold prices. Exploration below the old underground workings, done by Metals Exploration (Asia) Inc. in 1970 indicated minable reserves of 1.35 million tons of ore grading 13.57 grams of gold per ton. During the 1987 exploration of the site, Paragon established a high-grade open pit resource containing an indicated 800,000 tons of ore at a grade of 13 grams of gold per ton to a depth of 122 meters.

Gold production in the Philippines was ranked ninth in the world in 1987, dropping one place from the 1986 ranking. According to the Chamber of Mines of the Philippines, gold production by companies and small-scale gold panners was as follows, in troy ounces:[5]

Company	1986	1987
Benguet Corp. (primary and by-product)	246,100	249,137
Philex Mining Corp. (byproduct)	214,786	158,068
Atlas Consolidated Mining and Development Corp. (primary and by-product)	139,415	139,846
Lepanto Consolidated Mining Co. Inc. (byproduct)	60,996	73,373
Apex Mining Co. Inc. (primary)	43,476	44,952
Surigao Consolidated Mining Co. (primary)	34,717	39,596
Marcopper Mining Corp. (byproduct)	18,775	19,091
Benquet Exploration Inc. (primary and byproduct)	10,837	11,368
Itogon-Suyoc Mines Inc. (primary)	15,640	11,115
Maricalum Mining Corp. (byproduct)	9,908	9,267
North Davao Mining Corp. (by-product)	11,828	9,212
Manila Mining Corp. (primary)	7,628	8,086
Small-scale gold panners[e]	482,300	500,000
Total	1,296,406	1,273,111

[e]Estimated.

Nickel.—At yearend, Pacific Metals Co. of Japan, a Japanese ferronickel producer, imported from the newly opened Taganito Mine in northern Mindanao, the first shipment of 25,000 tons of nickel ore for testing purposes. The mine was opened in late 1987 on an exploratory basis, and was reported to have large resources averaging more than 2.4% nickel. Reportedly, Pacific Metals was planning to import 70,000 to 80,000 tons of nickel ore annually until the mine was fully developed.[6]

Nonoc Mining and Industrial Corp. (NMIC) pursued efforts to reopen its mine and refinery in Surigao, shut down since March 1986 by a labor strike and pervasive financial difficulties. NMIC was believed to have approached the leading South Korean steel company, Pohang Iron and Steel Co., for $30 million in aid. Reportedly, NMIC's creditors were approached by the Soviet metal trading and equipment company, Tsvetmetpromexport, for help in rehabilitating and operating NMIC.[7] Although the details of possible Soviet involvement was unknown at yearend, indications were that the U.S.S.R. was offering foreign investment, or equipment and spare parts, or personnel, technical assistance, and training in a barter arrangment for nickel or copper products. To resume operations, NMIC was believed to need more than $20 million to cover back wages for the workers, installation of a cable belt conveyor, spare parts and plant rehabilitation, and rebuild the inventory. NMIC filed a petition on

February 27 with the Government to stop a series of legal actions against the firm and to protect its dwindling assets. The refinery had an effective capacity of 16,000 tons of refined nickel per year before it shut down.

Steel.—Total steel products demand in the Philippines was 826,000 tons in 1986, the latest year for which official data were available. National Steel Corp., the country's largest steel producer, covered about 68% of the market. National Steel supplied about 97% of total demand for cold-roll sheets; 65% of the market for tinplate; 58% of the market for billets; and 57% of demand for hot-roll sheets.

INDUSTRIAL MINERALS

Cement.—The Philippine cement industry, which in recent years had been operating at about 50% of capacity, was thrust to the brink of having to import after the Government initiated a $195 million housing-construction program and a $180 million roadbuilding program to boost the country's economy. The country's 13 operating cement factories—5 plants had closed in recent years—operated at near capacity throughout 1987.

Fertilizer Materials.—The phosphate fertilizer mine at Batinque on Leyte was closed temporarily in early 1987 owing to a shortage of working capital. As a consequence, Philippines Phosphate Fertilizer Corp. (Philphos) became entirely dependent upon imported phosphate rock from Nauru for the operation of its fertilizer plant at Batinque. Philphos had been blending impure Batinque rock with that from Nauru because the company claimed that Nauru rock alone was not fully suitable for the plant. Despite the high quality of Nauru rock, a better phosphate recovery could be obtained from blending both types of rock.

Sulfur.—Freeport-McMoRan Inc. of the United States and International Consultex (Philippines) Inc. were planning to open a joint-venture surface sulfur mine at Pamplona, Negros Oriental Province, Negros Island, in the central Philippines. The proposed project, depending upon the processing technology and the capacity, would cost between $50 million and $100 million.

MINERAL FUELS

Coal.—Piedra Negra Mining Corp. (PNMC) discovered a high-grade coal deposit in the Tandag-Marihatag-Lianga coal basin in Surigao del Sur Province, northern Mindanao, estimated to contain 182 million tons. PNMC submitted to the Ministry of Energy a 5-year work program in which the company planned to produce 40,200 tons of coal during the second year of production, increasing to 93,000 tons by the fifth year. Both proposed production and the initial year of operation were unknown.

Petroleum.—Crude petroleum was produced from three oilfields—Cadlao, Malintoc, and Nido—during the year, accounting for about 5% of the country's requirements. Crude petroleum remained the country's largest single commodity import in terms of value, with Saudia Arabia the principal supplier. The Philippines had three oil refineries to process crude, but domestic consumption remained larger than these facilities could supply. There remained little interest in exploration for oil; only seismic surveys were made during the year.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from the Philippine peso (P) to U.S. dollars at the rate of P20.6=US$1.00.

[3]American Metal Market. V. 95, No. 55, Mar. 23, 1987. p. 3.

[4]Chamber of Mines of the Philippines. CMP Newsletter. V. 13, No. 1, Jan. 1988, p. 3.

[5]Page 4 of work cited in footnote 4.

[6]American Metal Market. V. 96, No. 6, Jan. 11, 1988, p. 2.

[7]Far Eastern Economic Review (Hong Kong). V. 136, No. 14, Apr. 2, 1987, p. 8.

The Mineral Industry of Poland

By Walter G. Steblez[1]

In 1987, Poland's centrally planned economy continued to improve, showing modest growth in national income and a 3.3% growth in industrial output compared with those in 1986. Mining output, accounting for 7% of gross industrial production, remained largely at the output level of 1986. The production of Poland's iron and steel industry declined slightly compared with that of 1986; however, the output of nonferrous metals remained at about 1986 production levels. For the same period, the bituminous coal industry showed slight gains; on the other hand, metal fabricating, chemical, brown coal and lignite mining, and machine-building and toolmaking industries grew by 5.1%, 5.2%, 8.9%, and 8.2%, respectively. By yearend 1986 there were about 1.1 million workers employed in the fuels and energy, industrial minerals, and metallurgical industries, which represented about 25% of the industrial work force.[2] By yearend, Poland's mining and extracting industries increased their labor forces by 4,000 workers. The average monthly wage in the country's mining sector remained the highest in industry: almost twice that of the construction sector, which was second to mining in terms of wage scale. In 1987, the average wage increases for employees in the mining sector grew by 19% compared with those of 1986. However, during the same period, the cost of living for industrial workers rose by 26%.

The dispute and ensuing strikes that arose in 1986 between Poland's copper miners and the Government over the wage differential between coal and copper mining sectors was reportedly resolved in late 1987. The Government originally maintained the position that benefits granted to the coal industry were not applicable to the copper industry because the latter was not subsidized and did represent a special exception to Poland's economic reform policies. The reversal of the Government's decision placed the country's copper and other metallurgical industries on an equal footing in terms of wages with the coal industry. Other major events in the minerals industry included the discovery of gold in Lower Silesia, the exhaustion and partial decommissioning of the Konrad copper mine, and the continued construction of the Kosciusko power station to supply electricity to the Osiek sulfur mine.

Government Policies and Programs.—Government policies continued to be aimed at streamlining both production and consumption of minerals. To this end, the indexes of both productivity and consumption of minerals and basic materials showed improvement over those in 1986. A major streamlining effort was initiated in October 1987 to consolidate the mining, processing, and fabricating sectors of industry. The Ministry of Mining and Energy was abolished, and its functions and subdivisions subordinated under the Ministry of Industry.

PRODUCTION

Despite a number of proposed economic reforms, Poland's mineral industry remained centrally planned and state-owned and operated. The country's output of bituminous coal, copper, silver, and sulfur continued to be of world significance and, by European standards, Poland remained an important producer of cadmium, lead, salt, and zinc.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum metal, primary	44,400	45,900	47,000	47,500	[3]47,500
Cadmium metal, primary[e]	570	570	600	620	600
Copper:					
Mine output, Cu content, recoverable	402,300	431,000	[e]431,000	434,000	437,000
Metal:					
Smelter, including secondary[e]	362,000	375,000	390,000	400,000	410,000
Refined, including secondary	360,000	372,300	387,000	[e]388,000	[3]390,000
Gold:[e]					
Mine output, Au content, recoverable thousand troy ounces	1,040	1,110	1,110	1,110	1,110
Metal, smelter[4] troy ounces	5,800	5,800	5,800	5,800	5,800
Iron and steel:					
Iron ore and concentrate, gross weight thousand tons	10	11	11	9	[3]6
Metal:					
Pig iron do	9,716	9,981	9,807	10,574	[3]10,476
Ferroalloys:					
Blast furnace do	88	94	[e]83	[e]83	85
Electric furnace do	175	174	[e]177	[e]176	180
Steel:					
Crude do	16,236	16,533	16,126	17,144	[3]17,145
Semimanufactures:					
Rolled excluding pipe do	11,731	12,195	11,845	12,340	[3]12,412
Pipe do	995	1,010	992	1,027	[3]1,038
Lead:					
Mine output, Pb content, recoverable	47,000	52,800	[e]53,000	[e]53,500	54,000
Metal, smelter	81,000	83,400	87,300	88,300	[3]89,500
Nickel:[e]					
Mine output, Ni content, recoverable	2,100	2,100	2,000	2,000	2,000
Metal, smelter	2,100	2,100	2,000	1,900	1,900
Silver, mine output, Ag content, recoverable thousand troy ounces	21,798	23,920	26,717	26,653	[3]26,717
Zinc:					
Mine output, Zn content	189,000	190,700	187,000	185,000	184,000
Metal, refined, including secondary	170,300	176,000	180,000	179,000	[3]177,000
INDUSTRIAL MINERALS					
Barite	81,000	91,000	91,000	98,000	[3]59,300
Cement, hydraulic thousand tons	16,200	16,700	15,000	15,831	[3]16,100
Clays and clay products:					
Crude:					
Bentonite[e] do	70	70	75	75	75
Fire clay do	[r]1,124	1,037	980	1,076	1,100
Kaolin do	49	[e]50	48	49	49
Products[e] do	600	600	550	600	600
Feldspar[e] do	80	80	80	80	80
Gypsum and anhydrite, crude[5] do	927	1,167	973	1,107	1,110
Lime, hydrated and quicklime do	4,121	4,251	4,124	4,151	[3]4,261
Magnesite, crude	16,100	[r]20,600	19,200	20,900	[3]21,000
Nitrogen: N content of ammonia thousand tons	1,739	1,822	1,812	2,124	2,100
Salt:					
Rock do	[r]1,130	1,185	1,198	1,222	[3]1,234
Other do	3,196	3,526	3,660	4,197	[3]4,934
Sodium compounds, n.e.s.:					
Sodium carbonate (soda ash) do	825	918	939	963	970
Caustic soda (96% NaOH) do	408	[r]434	431	445	450
Stone: Dolomite do	2,996	3,227	3,025	3,333	[3]3,511
Sulfur:					
Native:					
Frasch do	4,526	4,485	4,326	4,437	4,400
Other than Frasch do	473	505	550	457	567
Total do	[r]4,999	4,990	4,876	4,894	[3]4,967
Byproduct:[e]					
From metallurgy do	170	170	170	170	170
From petroleum do	30	30	30	30	25
Total do	200	200	200	200	195
From gypsum[e] do	20	20	20	20	22
Total sulfur do	[r]5,219	5,210	5,096	5,114	5,184

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Bituminous thousand tons	191,100	191,592	191,642	192,080	[3]193,010
Lignite and brown do	42,500	50,400	57,800	67,257	[3]73,200
Total do	233,600	241,992	249,442	259,337	[3]266,210
Coke:					
Coke oven do	17,100	16,200	16,000	16,400	[3]17,100
Gashouse[e] do	600	600	620	610	610
Total[e] do	17,700	16,800	16,620	17,008	17,710
Fuel briquets, all grades do	[e]1,500	719	1,010	1,309	1,380
Gas:					
Manufactured:					
Town gas million cubic feet	9,641	9,041	7,875	6,427	6,500
Coke oven gas do	222,306	217,114	208,780	216,832	217,000
Natural, marketed do	193,230	214,430	225,024	205,708	[3]208,882
Natural gas liquids:[e]					
Natural gasoline thousand 42-gallon barrels	80	80	75	80	80
Propane and butane do	53	53	50	60	60
Peat: Fuel and agricultural[e]	200,000	200,000	200,000	200,000	250,000
Petroleum:					
Crude:					
As reported thousand tons	210	189	194	167	[3]149
Converted thousand 42-gallon barrels	1,558	1,401	1,439	1,239	[3]1,105
Refinery products[6] do	95,501	95,529	98,469	100,086	[3]115,020

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

[1]Table includes data available through Aug. 26, 1988.

[2]In addition to the commodities listed, antimony, cobalt, germanium, 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]Based on official Polish estimates.

[5]Includes building gypsum, as well as an estimate for gypsum used in production of cement.

[6]Includes virtually all major products; excludes some minor products as well as refinery fuel and losses.

TRADE

Poland's total trade returns for 1987 in current prices showed a slight deficit in soft currency trade accounting within the Council for Mutual Economic Assistance (CMEA) bloc. Planned exports to CMEA countries were exceeded by 1.1%, while planned imports increased by 2.9%. However, this deficit was viewed favorably compared with deficits in previous years. Total hard currency trade with market economy countries in current prices showed exports exceeding imports by more than 21% with a yearend account surplus of $1.24 billion. Overall, Poland's hard currency balance of payments deficit increased from $33.5 billion in 1986 to $37.6 billion in 1987. Reportedly, the decline in the dollar's value accounted for a $2.9 billion increase in this debt. Significantly, Poland's exports of bituminous coal to market economy countries in 1987 declined by 9.8% compared with those of 1986. The U.S.S.R. remained Poland's most important trade partner. As a member of CMEA, Poland continued to participate in the CMEA program to develop fuel and mineral resources on Soviet territory to assure long-term supplies of electricity, petroleum, natural gas, and metals. In 1987, the U.S.S.R. supplied Poland with 100.2 million barrels of petroleum, 18.5 million barrels of refinery products, 265.9 billion cubic feet of natural gas, 11.6 million tons of iron ore, 1.4 million tons of pig iron, and 83,000 tons of ferroalloys.

Also, during the same period, Soviet exports to Poland of chromite and manganese ore amounted to 149,000 and 342,000 tons, respectively. Soviet mineral imports from Poland included 9.6 million tons of bituminous coal and 1.2 million tons of bituminous coke.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	500	--		
Oxides and hydroxides	41	53	--	Thailand 20; United Kingdom 18; Norway 11.
Ash and residue containing aluminum	577	591	--	All to West Germany.
Metal including alloys:				
Scrap	199	3,668	--	West Germany 2,280; Finland 909; France 248.
Unwrought[2]	2,980	3,023	--	Czechoslovakia 2,702; West Germany 250; Italy 70.
Semimanufactures	777	[2]688	--	Finland 493; Italy 82; Austria 69.
Chromium:				
Ore and concentrate	--	2	--	All to Chile.
Oxides and hydroxides	[2]1,516	1,442	--	Finland 441; Sweden 431; Yugoslavia 145.
Cobalt: Metal including alloys, all forms	2	--		
Columbium and tantalum: Metal including alloys, all forms, tantalum	6	--		
Copper:				
Ore and concentrate	80,112	39,990	--	Canada 19,631; West Germany 14,949; Finland 5,410.
Matte and speiss including cement copper	20	22	--	All to Greece.
Sulfate	1,805	2,798	--	West Germany 1,605; Netherlands 873; Yugoslavia 320.
Metal including alloys:				
Scrap	698	757	--	West Germany 462; United Kingdom 107; France 99.
Unwrought[2]	181,948	169,431	--	West Germany 90,759; United Kingdom 36,544; Belgium-Luxembourg 12,388.
Semimanufactures[2]	62,354	73,149	55	Czechoslovakia 19,795; U.S.S.R. 12,621; West Germany 8,185.
Gold: Metal including alloys, unwrought and partly wrought value, thousands	$783	$2	--	All to Netherlands.
Iron and steel: Metal:				
Scrap[2]	79,993	73,883	--	Yugoslavia 52,338; Switzerland 7,862; Netherlands 6,543.
Pig iron, cast iron, related materials	1,652	100	--	West Germany 47; Yugoslavia 25; Denmark 19.
Ferroalloys:				
Ferrochromium	37	244	--	Belgium-Luxembourg 220; West Germany 24.
Ferrosilicon	657	721	--	All to West Germany.
Silicon metal	1	--		
Unspecified	1,393	1,153	--	Yugoslavia 500; Austria 378; West Germany 250.
Steel, primary forms	101,000	125,000	216	Yugoslavia 71,896; United Kingdom 27,064; Belgium-Luxembourg 24,685.
Semimanufactures:				
Bars, rods, angles, shapes, sections thousand tons	1,389	1,460	16	U.S.S.R. 845; West Germany 122; Czechoslovakia 91.
Universals, plates, sheets do	356	329	19	U.S.S.R. 56; West Germany 28; United Kingdom 28.
Hoop and strip do	114	98	--	Yugoslavia 28; United Kingdom 6; unspecified 57.
Rails and accessories do	93	156	--	NA.
Wire do	42	29	([3])	West Germany 7; Yugoslavia 3; unspecified 14.
Tubes, pipes, fittings do	34	31	4	East Germany 20; West Germany 6.
Castings and forgings, rough do	4	5	--	Mainly to Hungary.
Lead:				
Oxides	18	--		
Ash and residue containing lead	1,342	54	--	All to United Kingdom.
Metal including alloys:				
Scrap	40	147	--	Sweden 123; West Germany 24.
Unwrought	--	98	--	All to Sweden.
Molybdenum: Metal including alloys, all forms	--	2	--	All to Belgium-Luxembourg.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Nickel:				
Oxides and hydroxides	1	--		
Metal including alloys:				
Unwrought	--	33	--	All to Netherlands.
Semimanufactures	--	1	--	All to Yugoslavia.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$535	$20	--	Belgium-Luxembourg $15; Netherlands $5.
Silver:				
Ore and concentrate ---do	[4]$791	$1,085	--	All to Canada.
Waste and sweepings ---do	$441	[4]$1,128	--	West Germany $747; Switzerland $381.
Metal including alloys, unwrought and partly wrought[2] thousand troy ounces	17,651	12,989	965	Switzerland 5,337; Belgium-Luxembourg 2,218; West Germany 1,800.
Tin: Ash and residue containing tin	--	465	--	All to United Kingdom.
Titanium: Oxides	293	195	--	Yugoslavia 175; Italy 20.
Zinc:				
Ore and concentrate	[2]17,718	--		
Oxides	906	627	--	West Germany 612; Sweden 15.
Ash and residue containing zinc	--	302	--	All to Belgium-Luxembourg.
Metal including alloys:				
Scrap	146	383	--	All to West Germany.
Unwrought[2]	28,050	22,562	1,183	Hungary 12,880; West Germany 2,000; United Kingdom 2,000.
Semimanufactures[2]	3,603	2,994	39	Czechoslovakia 1,202; U.S.S.R. 909; West Germany 440.
Other:				
Ores and concentrates	6	--		
Ashes and residues	2,888	--		
Base metals including alloys, all forms	1,682	1,482	--	Czechoslovakia 1,477; West Germany 5.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	155	271	--	Yugoslavia 222; Pakistan 21; West Germany 18.
Artificial:				
Corundum	5,864	3,155	--	West Germany 1,926; Yugoslavia 759; Italy 208.
Silicon carbide	416	1,049	--	France 550; West Germany 489; Belgium-Luxembourg 10.
Grinding and polishing wheels and stones	289	463	[3]	Italy 300; Yugoslavia 106; United Kingdom 25.
Cement[2] thousand tons	1,264	952	--	U.S.S.R. 399; Sweden 212; West Germany 107.
Clays, crude:				
Bentonite	--	24	--	All to Italy.
Chamotte earth	[2]12,636	2,181	--	Hungary 2,036; West Germany 145.
Fire clay	[2]11,476	1,008	--	All to Yugoslavia.
Kaolin	5	--		
Unspecified	125	20,713	--	Hungary 13,546; Yugoslavia 5,425; Austria 1,163.
Diamond:				
Gem, not set or strung value, thousands	$380	--		
Industrial stones ---do	$167	$46	--	Belgium-Luxembourg $38; West Germany $7; Switzerland $1.
Diatomite and other infusorial earth	367	--		
Fertilizer materials:				
Crude, n.e.s	--	23	--	All to West Germany.
Manufactured:				
Ammonia[2]	70,775	141,939	--	Sweden 63,195; West Germany 42,347; Spain 16,928.
Nitrogenous[2]	243,032	193,039	--	West Germany 43,387; France 40,000; Denmark 21,000.
Phosphatic	4,176	[2]30,000	--	Czechoslovakia 22,000; West Germany 6,000; Netherlands 2,000.
Unspecified and mixed	1,307	32,104	--	Denmark 19,784; West Germany 9,732; Italy 809.
Graphite, natural	25	--		
Gypsum and plaster	[2]50,596	6,623	--	Finland 4,070; Norway 2,548; Sweden 5.
Kyanite and related materials	--	550	--	West Germany 325; Italy 125; Spain 100.
Lime[2]	51,155	48,706	--	West Germany 48,703.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Magnesium compounds	6	--		
Nitrates, crude	--	20	--	All to Finland.
Pigments, mineral: Iron oxides and hydroxides, processed	--	20	--	All to Yugoslavia.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$2	$6	$6	
Synthetic do.	$227	$21	--	All to Japan.
Pyrite, unroasted	--	2,566	--	All to Jordan.
Salt and brine[2]	380,110	327,246	--	Finland 145,723; Sweden 107,690; Hungary 68,758.
Sodium compounds, n.e.s.:				
Carbonate, manufactured[2]	256,289	252,642	--	China 111,909; U.S.S.R. 45,483; Czechoslovakia 16,425.
Sulfate, manufactured	1,436	334	--	Canada 234; Uruguay 100.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked[2]	13,207	13,972	--	West Germany 10,591; Sweden 2,082; Denmark 977.
Worked	9,610	12,944	--	West Germany 9,370; Denmark 3,016; Sweden 490.
Dolomite, chiefly refractory-grade[2]	3,429	--		
Gravel and crushed rock	76,445	82,040	--	All to West Germany.
Limestone other than dimension	4,705	1,955	--	Do.
Quartz and quartzite	1,382	25	--	All to Italy.
Sand other than metal-bearing	118,475	154,928	--	West Germany 154,886; United Kingdom 36; Jordan 6.
Sulfur:				
Elemental:				
Crude including native and by-product[2] thousand tons	3,906	3,823	--	U.S.S.R. 871; Czechoslovakia 487; Brazil 396.
Colloidal, precipitated, sublimed	11,770	35,799	--	Jordan 25,710; Sweden 9,836; Yugoslavia 243.
Dioxide	3,404	3,773	--	All to West Germany.
Sulfuric acid[2]	108,091	97,975	--	All to U.S.S.R.
Other:				
Crude	16,192	6,887	--	West Germany 6,714; Austria 172; Denmark 1.
Slag and dross, not metal-bearing	87,458	14,310	--	West Germany 14,236; France 74.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	12	--		
Coal:				
Anthracite and bituminous[2] thousand tons	36,156	34,315	--	U.S.S.R. 11,693; Finland 2,380; West Germany 2,238.
Briquets of anthracite and bituminous coal do.	2	[2]65	--	Hungary 60; Switzerland 5.
Lignite including briquets do.	[2]201	1	--	All to West Germany.
Coke and semicoke[2] do.	1,639	1,545	--	U.S.S.R. 721; East Germany 169; Austria 146.
Peat including briquets and litter[2]	5,173	4,937	--	Austria 3,593; Italy 1,057; Egypt 283.
Petroleum:				
Crude thousand 42-gallon barrels	942	3,328	--	United Kingdom 3,133; Italy 195.
Refinery products:				
Liquefied petroleum gas do.	115	157	--	All to West Germany.
Gasoline do.	174	577	--	Sweden 400; West Germany 168; Denmark 6.
Mineral jelly and wax do.	37	37	--	Netherlands 19; Austria 14; Finland 3.
Kerosene and jet fuel do.	21	19	--	All to Hungary.
Distillate fuel oil do.	1,161	436	--	West Germany 246; Norway 127; Sweden 25.
Lubricants do.	329	219	--	Austria 83; Sweden 44; West Germany 39.
Residual fuel oil do.	539	317	--	Sweden 213; West Germany 65; Austria 27.
Bitumen and other residues do.	2	7	--	Austria 5; West Germany 2.
Bituminous mixtures do.	[3]	[3]	--	All to Finland.
Unspecified do.	1,152	1,562	NA	NA.

[p]Preliminary. NA Not available.

[1]Table prepared by Jozef Plachy. 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 trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries.

[2]Official Trade Statistics of Poland.

[3]Less than 1/2 unit.

[4]May include other precious metals.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate[2]	37,862	49,311	--	Hungary 20,609; Albania 11,903; Australia 8,445.
Oxides and hydroxides[2]	206,591	225,213	6,856	France 131,641; Hungary 75,678; Switzerland 17,897.
Metal including alloys:				
Scrap	285	2	--	All from West Germany.
Unwrought[2]	86,391	88,207	--	U.S.S.R. 38,759; West Germany 20,193; Romania 12,654.
Semimanufactures[2]	9,232	11,697	(3)	U.S.S.R. 6,306; Czechoslovakia 2,121; West Germany 1,544.
Antimony: Metal including alloys, all forms	34	--		
Chromium:				
Ore and concentrate[2]	151,093	145,790	--	U.S.S.R. 136,196; Albania 5,143; Turkey 4,451.
Oxides and hydroxides	212	320	--	All from United Kingdom.
Metal including alloys, all forms	--	1	--	All from West Germany.
Cobalt: Metal including alloys, all forms	21	11	--	Do.
Columbium and tantalum: Metal including alloys, all forms:				
Columbium (niobium)	(3)	--		
Tantalum	--	(3)	(3)	
Copper:				
Ore and concentrate	2	--		
Oxides and hydroxides	107	30	--	All from United Kingdom.
Metal including alloys:				
Scrap	122	765	--	Sweden 730; West Germany 20; Netherlands 15.
Unwrought[2]	19,991	18,211	--	All from United Kingdom.
Semimanufactures[2]	1,212	917	--	U.S.S.R. 318; West Germany 283; France 137.
Gold: Metal including alloys, unwrought and partly wrought value, thousands	$682	$497	--	West Germany $458; Netherlands $22; Italy $17.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite[2] thousand tons	16,973	16,640	--	U.S.S.R. 14,109; Brazil 205; India 143.
Metal:				
Scrap do	5	5	--	U.S.S.R. 3.
Pig iron, cast iron, related materials do	1,330	1,391	--	NA.
Ferroalloys:				
Ferrochromium	1,804	1,315	--	Yugoslavia 1,193; West Germany 102; Netherlands 20.
Ferromanganese	24,000	27,000	--	France 3,000; Norway 500; unspecified 23,500.
Ferromolybdenum	64	40	--	All from West Germany.
Silicon metal	4,918	4,107	--	All from Yugoslavia.
Unspecified	25,132	27,645	--	NA.
Steel, primary forms	13,000	17,240	--	Yugoslavia 14,555; West Germany 2,238; Hungary 335.
Semimanufactures:				
Bars, rods, angles, shapes, sections thousand tons	325	272	--	Czechoslovakia 184; Yugoslavia 22; Hungary 17.
Universals, plates, sheets do	634	637	41	Czechoslovakia 141; U.S.S.R. 32; unspecified 322.
Hoop and strip do	60	61	(3)	West Germany 11; Yugoslavia 7; unspecified 39.
Rails and accessories do	17	19	--	NA.
Wire do	49	50		West Germany 4; Italy 4; unspecified 33.
Tubes, pipes, fittings do	243	261	(3)	Romania 103; West Germany 52; East Germany 17.
Castings and forgings, rough do	13	11	--	Hungary 3; unspecified 7.
Lead:				
Ore and concentrate[2]	300	--		
Oxides	280	65	--	All from Italy.
Metal including alloys:				
Unwrought[2]	6,195	3,041	--	All from United Kingdom.
Semimanufactures	24	134	--	United Kingdom 86; Belgium-Luxembourg 48.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Magnesium: Metal including alloys, unwrought[2]	1,454	649	--	France 451; Belgium-Luxembourg 197.
Manganese:				
Ore and concentrate, metallurgical-grade[2]	617,977	670,843	--	U.S.S.R. 569,511; Italy 101,330.
Oxides	--	440	--	Japan 280; Greece 160.
Molybdenum:				
Ore and concentrate	39	--		
Oxides and hydroxides	--	1	--	All from West Germany.
Metal including alloys, all forms	1	--		
Nickel:				
Matte and speiss, Ni content	150	--		
Oxides and hydroxides	1	--		
Metal including alloys:				
Unwrought	--	1	--	All from United Kingdom.
Semimanufactures	66	98	14	West Germany 69; United Kingdom 6.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$1,635	$5,881	$1	Switzerland $4,781; West Germany $1,042; United Kingdom $42.
Rare-earth metals including alloys, all forms	--	1	--	All from France.
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$406	$300	--	West Germany $231; France $37; United Kingdom $16.
Tin:				
Oxides	9	--		
Metal including alloys:				
Unwrought[2]	3,029	3,625	--	United Kingdom 3,435; France 129; Austria 40.
Semimanufactures	1	--		
Titanium:				
Ore and concentrate	2,924	1,872	--	All from Netherlands.
Oxides	1,101	840	--	United Kingdom 527; West Germany 273; Japan 40.
Metal including alloys, all forms	12	5	--	Japan 3; United Kingdom 2.
Tungsten: Metal including alloys, all forms	3	3	--	All from Netherlands.
Zinc:				
Ore and concentrate	4	--		
Oxides	2	4	--	All from United Kingdom.
Blue powder	--	8	--	All from Denmark.
Metal including alloys:				
Unwrought[2]	5,254	2,226	--	All from U.S.S.R.
Semimanufactures	13	3	--	All from West Germany.
Zirconium: Ore and concentrate	680	2,542	--	Do.
Other:				
Ores and concentrates	2,150	89,308	--	Norway 87,434; Australia 1,784; Austria 90.
Oxides and hydroxides	74	66	--	United Kingdom 38; Netherlands 15; West Germany 13.
Base metals including alloys, all forms[2]	15,423	11,172	--	Romania 6,132; U.S.S.R. 5,015; Austria 17.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	760	322	30	Italy 216; Japan 70.
Artificial:				
Corundum	2,701	3,254	20	Yugoslavia 1,896; Hungary 1,077; Japan 228.
Silicon carbide	90	5	--	All from Italy.
Dust and powder of precious and semi-precious stones including diamond value, thousands	$380	$68	--	All from United Kingdom.
Grinding and polishing wheels and stones	1,410	1,055	31	Austria 365; Yugoslavia 213; West Germany 210.
Asbestos, crude[2]	81,690	81,038	--	U.S.S.R. 77,005; Canada 1,998; United Kingdom 818.
Barite and witherite	30	--		
Boron materials:				
Crude natural borates	16,293	--		
Oxides and acids	7,778	--		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Cement	32,002	37,952	--	East Germany 20,114; U.S.S.R. 17,800.
Chalk	409	22	--	France 20; Netherlands 2.
Clays, crude:				
Bentonite	5,329	5,211	20	Hungary 5,191.
Chamotte earth[2]	6,779	--		
Fire clay	107	40	--	All from Yugoslavia.
Kaolin[2]	145,961	160,181	--	Czechoslovakia 73,352; United Kingdom 32,744; U.S.S.R. 20,622.
Unspecified	--	222	20	Italy 109; West Germany 84.
Cryolite and chiolite	--	1	--	All from West Germany.
Diamond:				
Gem, not set or strung value, thousands	$258	$30	--	All from United Kingdom.
Industrial stones do.	$2,169	$1,466	--	Belgium-Luxembourg $877; Switzerland $300; West Germany $270.
Diatomite and other infusorial earth	2,175	1,601	1,495	Denmark 60; France 40.
Feldspar, fluorspar, related materials	1,837	7,968	--	Norway 6,259; Finland 1,709.
Fertilizer materials:				
Crude, n.e.s	--	2	--	All from Italy.
Manufactured:				
Ammonia[2] thousand tons	24	8	--	All from U.S.S.R.
Nitrogenous[2] do.	69	20	--	Romania 11; Switzerland 9.
Phosphatic do.	--	10	10	
Potassic[2] do.	2,357	2,373	--	U.S.S.R. 1,671; East Germany 672; Austria 30.
Unspecified and mixed do.	(3)	(3)	--	Mainly from Belgium-Luxembourg.
Graphite, natural[2]	6,082	3,929	49	Austria 2,008; Czechoslovakia 1,427; North Korea 195.
Gypsum and plaster	2,807	1,135	--	All from West Germany.
Kyanite and related materials	20	106	--	All from United Kingdom.
Lime	[2]32,016	9	--	All from France.
Magnesium compounds[2]	263,398	211,464	--	North Korea 92,652; Czechoslovakia 68,785; Brazil 23,172.
Mica:				
Crude including splittings and waste[2]	1,241	--		
Worked including agglomerated splittings	27	11	--	Austria 7; Switzerland 2; France 1.
Phosphates, crude[2] thousand tons	3,261	2,970	--	Morocco 1,237; U.S.S.R. 536; Jordan 419.
Phosphorus, elemental	15,337	13,716	--	All from U.S.S.R.
Pigments, mineral:				
Natural, crude	21	1	--	All from West Germany.
Iron oxides and hydroxides, processed	1,050	4	--	All from Belgium-Luxembourg.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$16	$11	--	West Germany $9; Austria $1; Hong Kong $1.
Synthetic do.	$110	$89	--	Austria $30; Switzerland $26; West Germany $22.
Salt and brine	1	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked[2]	3,487	15,700	--	Bulgaria 7,601; Czechoslovakia 6,290; Albania 1,744.
Worked	141	84	--	Italy 71; France 10; United Kingdom 2.
Dolomite, chiefly refractory-grade	[2]11,972	41	--	West Germany 26; Austria 15.
Gravel and crushed rock[2]	10,034	11,630	--	Norway 7,192; Czechoslovakia 2,550; Finland 1,888.
Limestone other than dimension	250	--		
Quartz and quartzite	3,120	3,414	--	West Germany 2,921; Sweden 342; Yugoslavia 91.
Sand other than metal-bearing	176	--		
Talc, steatite, soapstone, pyrophyllite[2]	20,944	23,154	--	North Korea 9,417; Czechoslovakia 6,555; China 2,023.
Vermiculite, perlite, chlorite	5	--		
Other:				
Crude	13,868	16,077	--	Hungary 14,816; West Germany 1,166; United Kingdom 75.
Slag and dross, not metal-bearing	--	2,957	--	West Germany 2,956; Yugoslavia 1.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	36	--		
Carbon black	[2]29,982	8,880	50	Sweden 5,804; West Germany 1,791; Netherlands 1,008.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coal:[2]				
Anthracite thousand tons	--	22	--	All from U.S.S.R.
Bituminous do	1,060	1,150	--	U.S.S.R. 836; East Germany 314.
Coke and semicoke do	35	73	--	United Kingdom 67; Belgium-Luxembourg 3; Sweden 3.
Gas, natural: Gaseous[2] million cubic feet	208,285	251,969	--	All from U.S.S.R.
Peat including briquets and litter	30	159	--	All from Ireland.
Petroleum:[2]				
Crude thousand 42-gallon barrels	100,778	103,939	--	U.S.S.R. 100,622; Iran 1,946; Iraq 1,006.
Refinery products do	26,174	27,432	101	U.S.S.R. 16,581; Romania 708; Albania 399.

[p]Preliminary. NA Not available.

[1]Table prepared by Jozef Plachy. 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 trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries.

[2]Official Trade Statistics of Poland.

[3]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—With no domestic bauxite resources, Poland's aluminum industry relied entirely on imports of raw materials for processing and fabricating. Production of aluminum remained at the same level as that in 1986. In 1987, Poland signed a cooperative agreement with the U.S.S.R. that enabled the Konin aluminum mill in western Poland to ship primary aluminum alloys to the U.S.S.R. in exchange for rolling mill blocks for processing.

Copper.—The production of ore and electrolytic copper, in absolute terms, grew slightly in 1987 compared with that of 1986. The Kombinat Gorniczno-Hutniczy Miedi (KGHM), or the Copper Mining and Smelting Industrial Group managed the country's copper mining and processing industries in the Legnica-Glogow area in the southwestern part of Poland. The chief event in the industry during the year was the partial closure of the Konrad copper mine, near Iwiny, owing to the near depletion of reserves at the site. The Konrad Mine, the oldest copper mine in Poland, had been sustaining operational losses for several years, and the cessation of most operations entailed the elimination of about 2,000 jobs. Exploitation of accessible copper reserves was to continue for about 6 years. The mining of anhydrite, associated with the copper ore at Konrad, was begun during the year.

Production was to reach 10,000 tons by yearend, and potential future production was set at 500,000 tons per year. A collapse at the nearby Lubin Mine, caused by a strong earth tremor in mid-June, resulted in three serious injuries and four fatalities.

Gold.—In August, the State Institute of Geology reported the discovery of gold in the Sudety Mountains. Chrysoprase, emeralds, garnets, and rubies were also discovered in the region.

Iron and Steel.—Poland announced plans to install two 2-strand continuous slab casters with a combined capacity of 3 million tons per year at the Huta Katowice steelworks. Krupp AG of the Federal Republic of Germany would supply the casters and the deal would be financed by Polish steel deliveries to developing countries. The arrangement, however, was subject to further negotiations. Other developments included the announcement of yearend closure of the Huta Pokoj steelworks at Nowy Bytom. The steelworks had been operating at a loss marked by quality problems and environmental difficulties.

Lead and Zinc.—The production of lead

and zinc ore continued to decline slightly owing to limited investments and declining ore grades. A new line for continuous zinc casting was put into operation at the Boleslaw mining-metallurgical plant at Bukowno. The computer controlled plant with a 12-ton-per-hour-production capacity was designed and produced domestically.

INDUSTRIAL MINERALS

Salt and sulfur remained Poland's most important industrial minerals both in terms of reserves and export earnings. The country was also a producer of barite, dolomite, gypsum, limestone, and magnesite.

Sulfur extracted by open pit mining at the Machow Mine amounted to about 12% of total output in 1987. The balance of the country's sulfur production was done by the modified Frasch underground melting process, mainly at the Jeziorko, Grzybow, and Baznia Mines. In 1987, the construction of the Kosciusko power station was begun to supply power for sulfur melting at the Osiek Mine. Eventual output at the Osiek Mine was planned at 1.3 million tons of sulfur per year.

MINERAL FUELS

Coal.—Poland remained the fourth largest coal producer in the world. Coal met about 80% of Poland's energy requirements and provided one-fifth of the country's hard currency earnings. Coal production has been growing slowly and some concern was raised that the target for 1990 may not be met. Poland sought to diversify its energy base by increasing gas supplies from the Soviet Union and by the construction of two nuclear powerplants. In 1987, the Kopernik coal mining and processing complex in Lower Silesia was under development. By yearend, the complex's main shaft reached a depth of 500 feet and required a further 460 feet for completion. Reportedly, the development of the Kopernik Mine was the largest mining investment project in the area in the post-war period.

Natural Gas and Petroleum.—In 1987, geologists discovered deposits containing 3.7 million barrels of petroleum and 194 billion cubic feet of natural gas. A new oil well was put into operation in Gorzow Province, and three wells were put into operation at Koszalin, near Karlino. Geologists also indicated probable deposits at Szczecinek, Swizyna, and Karlino.

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[1]Foreign mineral specialist, Division of International Minerals.

[2]Rocznik Statystyczny (Statistical Handbook). 1987, pp. 150-163.

The Mineral Industry of Portugal

By John G. Panulas[1]

In 1987, Portugal's mineral industry remained small compared with those of other producing nations. Development of copper projects and modifications geared to increase iron and steel productivity were pursued during a period of improved economic performance, particularly in the construction industry. The country posted overall growth of 5%, with investment gaining 19% as a result of interest rate cuts and numerous tax and financial incentives tied to Portugal's European Economic Community (EEC) accession.

Government Policies and Programs.—The Portuguese Government continued its efforts to contain inflation by devaluing the escudo, a decision that made Portuguese mineral exports more competitive in the world markets. Of particular importance was the creation of a forward foreign exchange market that began operating in February 1987. The Bank of Portugal ended its practice of setting a daily exchange rate, leaving the rate to be determined by the market.

With a view toward sustaining long-term economic growth and stimulating investment, the Government implemented a system of tax relief that would reduce the industrial tax liability for 1987 by 10% on investments made in 1986; for 1988, by 8% on investments made in 1987; for 1989, by 6% on investments made in 1988; and for 1990, by 4% on investments made in 1989.

Moreover, the Government submitted legislation that would privatize many public companies. Such companies would be expected to fund their investment projects by means other than borrowing. These means include increased profits through lower wages and reduced import and interest costs, and the issue of securities. The privatization effort was part of a broader program to restructure the Portuguese economy from one that is state-controlled to one that is market-driven.

PRODUCTION

As in previous years, most major mineral producers were owned and operated by the Government. Small companies that engaged in the production of certain industrial minerals were privately held. With the exception of ferroalloys, dimension stone, and tungsten, production of minerals and related materials was significant only domestically.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
METALS					
Arsenic, white[e]	180	180	170	150	150
Beryl concentrate, gross weight	3	10	2	--	--
Columbite and tantalite concentrates, gross weight	[e]3	3	--	6	--
Copper:					
Ore and concentrate:					
Gross weight	1,735	1,654	1,183	865	800
Cu content	375	366	261	184	100
Metal:					
Smelter, primary and secondary	6,200	3,500	4,600	r [e]4,000	4,000
Refined, primary and secondary	[e]4,600	5,300	[e]4,500	r [e]5,300	4,800
Gold, mine output, Au content troy ounces	6,398	6,205	9,259	6,173	5,000
Iron and steel:					
Iron ore and concentrate:					
Gross weight:					
Hematite and magnetite	--	--	46,910	22,412	20,000
Manganiferous	35,500	36,000	26,300	28,200	22,000
Total	35,500	36,000	73,210	50,612	42,000
Iron content:					
Hematite and magnetite	--	--	2,017	9,413	11,000
Manganiferous	12,248	11,772	8,502	9,447	11,000
Total	12,248	11,772	10,519	18,860	22,000
Metal:					
Pig iron thousand tons	355	373	415	420	435
Ferroalloys:					
Ferromanganese[e]	40,000	46,500	48,000	20,000	17,000
Silicomanganese[e]	18,500	24,000	25,000	10,000	8,000
Ferrosilicon[e]	[2]8,550	9,000	9,000	5,000	2,000
Silicon metal[e]	[2]9,800	10,500	11,000	7,000	3,000
Ferrotungsten	176	183	151	17	10
Total[e]	77,026	90,183	93,151	42,017	30,010
Steel, crude thousand tons	674	690	665	708	530
Lead: Refined, secondary	6,000	6,000	7,000	6,000	6,000
Manganese: Mn content of iron ore	2,663	2,448	1,768	2,087	[2]2,059
Silver, mine output, Ag content troy ounces	20,287	22,280	33,244	16,847	20,000
Tin:					
Mine output, Sn content	375	320	247	197	[2]91
Metal, primary and secondary	443	432	408	194	[2]22
Titanium, concentrates:					
Gross weight	270	164	[e]144	232	220
Content of TiO_2	135	82	72	116	110
Tungsten, mine output, W content	1,183	1,509	1,755	1,637	1,500
Uranium concentrate: U content	103	114	118	109	[2]167
Zinc: Smelter, primary	3,800	6,400	5,900	5,700	6,500
INDUSTRIAL MINERALS					
Barite	637	318	1,094	120	300
Cement, hydraulic thousand tons	6,063	5,539	5,364	5,444	5,800
Clays:					
Kaolin	103,088	104,388	80,097	54,841	[2]56,992
Refractory	196,262	291,592	[e]240,000	[e]250,000	240,000
Diatomite	1,870	1,600	1,600	2,120	2,000
Feldspar	33,509	29,003	29,011	33,740	32,000
Gypsum and anhydrite	249,032	227,708	[e]250,000	[e]230,000	240,000
Lime, hydrated and quicklime[e] thousand tons	230	210	200	200	200
Lithium minerals: Lepidolite	545	985	130	--	--
Nitrogen: N content of ammonia thousand tons	111	160	154	[e]150	155
Pyrites and pyrrhotite (including cuprous), gross weight do	280	334	356	328	[2]279
Salt:					
Rock do	429	455	463	459	[2]513
Marine[e] do	110	110	115	110	[2]123
Total do	539	565	578	569	636
Sand do	4,249	NA	NA	NA	NA
Sodium compounds, n.e.s.:[e]					
Sodium carbonate	160,000	150,000	150,000	155,000	160,000
Sodium sulfate	56,000	50,000	50,000	52,000	55,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
INDUSTRIAL MINERALS —Continued					
Stone:					
Basalt ____ thousand tons	115	63	NA	NA	NA
Calcareous:					
Dolomite ____ do	117	157	NA	NA	NA
Limestone, marl, calcite ____ do	10,059	10,985	NA	NA	NA
Marble ____ do	421	440	NA	NA	NA
Diorite ____ do	337	1,596	NA	NA	NA
Gabbro ____ do	1	45	NA	NA	NA
Granite ____ do	5,073	4,208	NA	NA	NA
Graywacke ____ do	1	1	NA	NA	NA
Ophite ____ do	29	48	NA	NA	NA
Quartz ____ do	129	125	NA	NA	NA
Quartzite ____ do	438	588	NA	NA	NA
Schist ____ do	112	NA	NA	NA	NA
Slate ____ do	37	NA	NA	NA	NA
Syenite ____ do	6	NA	NA	NA	NA
Sulfur:					
Content of pyrites ____ do	124	140	155	144	150
Byproduct, all sources[e] ____ do	5	4	5	5	5
Total ____ do	129	144	160	149	155
Talc ____	7,325	6,822	4,998	4,141	4,000
MINERAL FUELS AND RELATED MATERIALS					
Coal, anthracite ____ thousand tons	185	195	[e]237	209	240
Coke, metallurgical[e] ____ do	160	170	170	150	160
Gas, manufactured ____ million cubic feet	5,135	5,159	5,111	[e]4,700	4,800
Petroleum refinery products:					
Gasoline ____ thousand 42-gallon barrels	7,360	6,794	7,174	10,632	8,500
Jet fuel ____ do	3,688	4,416	4,150	5,111	4,900
Kerosene ____ do	271	240	225	227	220
Distillate fuel oil ____ do	16,113	13,875	14,509	16,550	16,800
Residual fuel oil ____ do	22,837	20,579	17,796	17,289	15,600
Liquefied petroleum gas ____ do	3,016	2,496	2,819	3,577	3,500
Unspecified ____ do	6,161	6,447	6,520	10,389	8,800
Refinery fuel and losses ____ do	413	3,983	1,748	3,995	3,900
Total ____ do	59,859	58,830	54,941	67,770	62,220

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through May 1988.
[2]Reported figure.

TRADE

In 1986, the latest year for which complete data were available, the current-account trade balance amounted to a surplus of $1.2 billion.[2] The major factors responsible for the surplus were a drop in oil and commodity prices and the increased inflow of capital transfers resulting from Portugal's entry into the EEC.

Portugal's EEC membership was also reflected in significantly different trade patterns. During the first 8 months of 1987, European countries took 82% of Portugal's exports, as opposed to 75% in 1982-83. Spain was responsible for much of this growth, importing about 8% of Portugal's products. The value of exports to the United States fell, from 10% of exports in 1985 to 6.5% in 1987, concomitant with changes in the dollar exchange rate. On balance, exports of goods equaled approximately 75% of imports.

In 1987, the value of mineral fuels accounted for 11.6% of the Portuguese import total and 1.6% of all exports. Metalliferous ores and scrap amounted to less than 1% of exports and less than 1% of imports.

Table 2.—Portugal: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	--	3	--	All to Ecuador.
Metal including alloys:				
Scrap	1,732	3,879	16	Spain 2,027; Netherlands 937; West Germany 416.
Unwrought	50	--		
Semimanufactures	673	5,008	--	Spain 3,780; France 418; Finland 74.
Chromium: Oxides and hydroxides	2	--		
Columbium and tantalum: Metal including alloys, all forms, tantalum	--	2	--	All to France.
Copper:				
Ore and concentrate	--	1	NA	NA.
Matte and speiss including cement copper	168	348	--	Spain 347; France 1.
Metal including alloys:				
Scrap	441	518	(2)	Netherlands 301; United Kingdom 111; Spain 53.
Unwrought	1,638	1,565	--	All to Belgium-Luxembourg.
Semimanufactures	1,949	3,459	1,048	Spain 1,593; France 401.
Iron and steel:				
Iron ore and concentrates, pyrite, roasted	40	--		
Metal:				
Scrap	4,013	10,821	--	Spain 6,505; Netherlands 2,231; United Kingdom 1,355.
Pig iron, cast iron, related materials	68	45	--	Cape Verde 19; France 19; United Kingdom 5.
Ferroalloys:				
Ferromanganese	11,918	21,404	--	France 13,108; Italy 2,877; Greece 2,649.
Unspecified	36,887	49,387	5,000	West Germany 11,775; Belgium-Luxembourg 6,600.
Steel, primary forms	156	9,063	--	Turkey 8,978; Angola 49; Italy 22.
Semimanufactures:				
Bars, rods, angles, shapes, sections	177,280	197,314	2	China 55,670; Algeria 40,474; Belgium-Luxembourg 17,834.
Universals, plates, sheets	92,978	68,892	17,102	Spain 24,240; Romania 8,822.
Hoop and strip	762	50	--	Mozambique 40; Italy 4; Spain 2.
Rails and accessories	81	207	2	Switzerland 141; Algeria 40; Guinea-Bissau 11.
Wire	5,504	6,244	--	Algeria 5,619; Spain 314; Egypt 220.
Tubes, pipes, fittings	7,043	4,284	599	France 942; West Germany 781.
Castings and forgings, rough	9,888	11,516	1,532	United Kingdom 4,216; Sweden 1,198.
Lead:				
Ore and concentrate	1,090	1,029	--	All to Belgium-Luxembourg.
Oxides	12	--		
Metal including alloys:				
Scrap	--	24	--	All to Spain.
Unwrought	66	60	--	United Kingdom 40; Liberia 20.
Semimanufactures	55	29	--	Morocco 26; Mozambique 2; Cape Verde 1.
Mercury 76-pound flasks	(2)	(2)	--	Mainly to Angola.
Nickel:				
Matte and speiss	2	--		
Metal including alloys:				
Scrap	14	3	--	All to West Germany.
Semimanufactures	(2)	3	--	Mainly to Angola.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$3,007	$1,798	--	France $891; United Kingdom $746; West Germany $155.
Silver:				
Waste and sweepings[3] do	$7	$313	--	France $273; West Germany $34; Switzerland $5.
Metal including alloys, unwrought and partly wrought do	$10	$7	--	Angola $4; Canada $2; Bahrain $1.
Tin: Metal including alloys:				
Scrap	127	76	--	All to United Kingdom.
Unwrought	--	2	--	All to Angola.
Semimanufactures	8	24	--	Spain 23.

See footnotes at end of table.

Table 2.—Portugal: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Titanium: Oxides	31	5	--	All to Cape Verde.
Tungsten:				
Ore and concentrate	2,603	1,455	140	Japan 616; Netherlands 242; United Kingdom 214.
Metal including alloys, all forms	--	20	--	Finland 7; United Kingdom 5; West Germany 4.
Zinc:				
Ore and concentrate	--	23	--	All to Spain.
Oxides	969	2,681	--	Italy 753; United Kingdom 448; France 439.
Metal including alloys:				
Scrap	--	1	--	All to Cape Verde.
Unwrought	20	66	--	United Kingdom 40; Spain 20; Cape Verde 4.
Semimanufactures	20	27	--	Mozambique 22; France 3; Guinea-Bissau 1.
Other:				
Ores and concentrates	49	1,065	--	All to Spain.
Ashes and residues	2,716	604	--	West Germany 306; Spain 243; United Kingdom 34.
Base metals including alloys, all forms	90	116	--	Netherlands 108; West Germany 4; United Kingdom 3.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	(2)	1	(2)	Mainly to Angola.
Grinding and polishing wheels and stones	80	78	(2)	Spain 36; West Germany 23; Kuwait 3.
Asbestos, crude	2	--		
Barite and witherite	--	20	--	All to Spain.
Cement	68,956	55,950	--	Ivory Coast 30,954; Guinea-Bissau 7,588; Cape Verde 5,226.
Chalk	2,364	72	--	Cape Verde 41; Angola 31.
Clays, crude	5,441	1,915	3	West Germany 850; Spain 772; Angola 175.
Diamond:				
Gem, not set or strung value, thousands	$34,494	$46,788	$490	Switzerland $39,115; Belgium-Luxembourg $7,183.
Industrial stones do	--	$133	$31	Switzerland $102.
Diatomite and other infusorial earth	94	8	--	All to Guinea-Bissau.
Feldspar, fluorspar, related materials	--	7,267	--	France 2,735; West Germany 2,290; Norway 1,297.
Fertilizer materials: Manufactured:				
Ammonia	6,669	24,942	--	Spain 24,883; Cape Verde 2; bunkers 57.
Nitrogenous	153,742	117,909	--	West Germany 76,334; France 17,860; Ireland 5,700.
Phosphatic	68,483	12,212	--	Ireland 4,350; Turkey 3,000; Spain 2,300.
Potassic	712	109	--	Cape Verde 90; São Tomé and Príncipe 19.
Unspecified and mixed	22,303	24,433	--	France 7,168; Cameroon 6,150; Ivory Coast 4,000.
Graphite, natural	1	--		
Gypsum and plaster	36	34	--	Cape Verde 29; Angola 5.
Lime	628	430	--	Cape Verde 223; Angola 146; Guinea-Bissau 41.
Magnesium compounds	36	2	NA	NA.
Mica:				
Crude including splittings and waste	646	484	--	United Kingdom 460; France 24.
Worked including agglomerated splittings	--	1	--	Mainly to Angola.
Pigments, mineral: Iron oxides and hydroxides, processed	35	21	--	Cape Verde 14; Mozambique 4; Guinea-Bissau 3.
Precious and semiprecious stones other than diamond, natural value, thousands	--	$12	$12	
Salt and brine	11,088	5,555	81	Netherlands 4,098; France 596; Nigeria 517.

See footnotes at end of table.

Table 2.—Portugal: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sodium compounds, n.e.s.: Carbonate, manufactured	463	100	--	All to Morocco.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	93,908	147,941	775	Spain 45,740; Italy 37,875; Japan 33,340.
Worked	336,181	447,278	40,674	West Germany 254,316; United Kingdom 28,467.
Gravel and crushed rock	1,219	2,368	--	Spain 2,088; West Germany 150; France 71.
Limestone other than dimension	29	46	--	Cape Verde 25; Benin 20.
Quartz and quartzite	12,924	6,716	--	Switzerland 6,202; United Kingdom 314; Ireland 200.
Sand other than metal-bearing	36,413	23,312	--	Greece 20,830; Morocco 2,250; Spain 144.
Sulfur:				
Elemental:				
Crude including native and byproduct	22	23	--	All to Mozambique.
Colloidal, precipitated, sublimed	--	68	--	All to Spain.
Sulfuric acid	18,174	11,260	--	Belgium-Luxembourg 10,403; Spain 727; Burkina Faso 28.
Talc, steatite, soapstone, pyrophyllite	47	80	--	Netherlands 40; Mozambique 20; Angola 19.
Other:				
Crude	25	227	4	Spain 138; Morocco 50; France 24.
Slag and dross, not metal-bearing	--	44	--	All to France.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	185	71	--	Angola 42; Cape Verde 29.
Carbon: Carbon black	558	1,733	--	Spain 645; Morocco 338; United Kingdom 246.
Coal: Anthracite and bituminous	5	8	--	All to Netherlands.
Coke and semicoke	55	43	--	Do.
Petroleum refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	132	268	--	Netherlands 251; Italy 17.
Gasoline do	483	2,272	--	United Kingdom 847; Netherlands 673; France 398.
Mineral jelly and wax do	3	16	--	Spain 10; United Kingdom 4; Zaire 1.
Kerosene and jet fuel do	2,389	3,016	32	Cape Verde 362; United Kingdom 282; bunkers 1,344.
Distillate fuel oil do	876	1,453	1	France 557; Spain 168; bunkers 209.
Lubricants do	158	337	--	United Kingdom 66; France 64.
Residual fuel oil do	5,844	2,601	--	France 695; Netherlands 533; United Kingdom 505.
Bitumen and other residues do	(2)	15	--	Spain 14.
Bituminous mixtures do	(2)	1	--	Mainly to Cape Verde.
Petroleum coke do	--	(2)	--	All to Spain.

NA Not available.
[1]Prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	8,374	--		
Oxides and hydroxides	6,254	8,197	23	United Kingdom 4,755; France 1,848; West Germany 1,196.
Metal including alloys:				
Scrap	2,261	72	--	Spain 39; Canada 13; Sweden 10.
Unwrought	35,752	38,984	--	Norway 10,886; Spain 7,824; Canada 6,292.
Semimanufactures	15,938	14,084	11	Spain 3,589; West Germany 2,691; Belgium-Luxembourg 1,932.
Beryllium: Metal including alloys, all forms	(2)	(2)	--	All from West Germany.
Chromium:				
Ore and concentrate	1,281	1,098	--	Belgium-Luxembourg 512; Netherlands 353; Republic of South Africa 193.
Oxides and hydroxides	146	96	--	West Germany 48; Italy 20; U.S.S.R. 15.
Cobalt: Oxides and hydroxides	8	15	2	United Kingdom 5; Finland 4; Netherlands 3.
Columbium and tantalum: Metal including alloys, all forms, tantalum	3	2	(2)	Mainly from France.
Copper:				
Ore and concentrate	3,052	--		
Matte and speiss including cement copper	(2)	147	147	
Metal including alloys:				
Scrap	243	309	20	United Kingdom 79; Italy 60; Republic of South Africa 38.
Unwrought	16,289	12,246	--	Chile 5,121; Peru 3,773; Canada 1,440.
Semimanufactures	13,913	11,536	5	Italy 2,717; Spain 2,590; West Germany 2,366.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	683,298	542,935	--	Canada 345,078; Venezuela 156,612; Mauritania 40,940.
Pyrite, roasted	--	20	--	All from United Kingdom.
Metal:				
Scrap	116,941	102,953	78	United Kingdom 78,890; U.S.S.R. 10,697; France 5,555.
Pig iron, cast iron, related materials	40,643	33,566	--	Spain 24,677; Brazil 2,016; West Germany 1,427.
Ferroalloys:				
Ferromanganese	2,369	180	--	West Germany 94; France 27; Netherlands 26.
Unspecified	21,049	1,697	24	France 603; United Kingdom 316; Spain 292.
Steel, primary forms	200,680	214,466	6,154	West Germany 96,153; Belgium-Luxembourg 58,063; France 19,809.
Semimanufactures:				
Bars, rods, angles, shapes, sections	165,742	170,002	4	Spain 98,115; France 24,784; West Germany 11,151.
Universals, plates, sheets	289,936	239,173	1	West Germany 47,201; Belgium-Luxembourg 44,476; Republic of South Africa 27,233.
Hoop and strip	37,334	35,649	1	West Germany 13,482; Belgium-Luxembourg 22,727; France 3,800.
Rails and accessories	7,848	8,557	--	United Kingdom 7,301; West Germany 964; Belgium-Luxembourg 219.
Wire	23,417	22,928	1	Spain 10,009; United Kingdom 4,595; Belgium-Luxembourg 2,577.
Tubes, pipes, fittings	30,120	30,688	54	Spain 8,451; West Germany 8,150; France 4,977.
Castings and forgings, rough	2,793	266	--	Spain 104; West Germany 52; France 37.
Lead:				
Oxides	684	862	--	West Germany 540; Spain 170; United Kingdom 140.
Metal including alloys:				
Scrap	14,937	6,235	82	Spain 5,926; United Kingdom 104; France 85.
Unwrought	20,149	346,092	726	Peru 331,841; Republic of South Africa 3,620; Morocco 3,315.
Semimanufactures	42	35	--	Spain 24; Netherlands 6; France 3.
Magnesium: Metal including alloys:				
Unwrought	--	16	--	United Kingdom 8; Norway 6; France 2.
Semimanufactures	5	3	(2)	Austria 1; Spain 1.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Manganese:				
Ore and concentrate, metallurgical-grade	125,820	126,703	--	Brazil 1,973; Netherlands 52; unspecified 124,673.
Oxides	1,227	1,226	--	Netherlands 694; Belgium-Luxembourg 328; Republic of South Africa 116.
Mercury 76-pound flasks	551	435	(2)	China 319; Algeria 87; Spain 26.
Molybdenum: Metal including alloy, all forms	6	2	(2)	Austria 1; United Kingdom 1.
Nickel:				
Matte and speiss	2	3	--	France 2; Netherlands 1.
Metal including alloys:				
Scrap	6	5	--	All from Spain.
Unwrought	260	347	--	Republic of South Africa 121; Canada 56; Zimbabwe 44.
Semimanufactures	233	200	(2)	Finland 59; West Germany 57; France 28.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$1,403	$2,691	--	United Kingdom $1,541; France $829; West Germany $266.
Silver: Metal including alloys, unwrought and partly wrought do	$9,220	$11,059	$1	West Germany $10,370; Spain $385; France $172.
Tin:				
Ore and concentrate	218	11	--	Uganda 6; Nigeria 5.
Metal including alloys:				
Unwrought	182	655	--	United Kingdom 344; Netherlands 112; Malaysia 60.
Semimanufactures	92	96	(2)	United Kingdom 51; West Germany 39; Netherlands 3.
Titanium: Oxides	9,029	10,183	694	Spain 2,691; Finland 2,350; United Kingdom 1,869.
Tungsten: Metal including alloys, all forms	9	15	(2)	West Germany 9; United Kingdom 5.
Zinc:				
Oxides	638	337	--	Peru 88; Spain 62; Netherlands 60.
Metal including alloys:				
Scrap	2,178	2,199	140	United Kingdom 648; Saudi Arabia 576; Peru 200.
Unwrought	11,076	11,143	--	Belgium-Luxembourg 3,968; United Kingdom 1,661; Canada 1,517.
Semimanufactures	1,349	1,552	(2)	United Kingdom 317; Italy 313; Belgium-Luxembourg 267.
Other:				
Ores and concentrates	4,277	2,493	--	Spain 1,634; Republic of South Africa 370; United Kingdom 229.
Ashes and residues	532	5,753	--	Spain 5,750; United Kingdom 3.
Base metals including alloys, all forms	65	135	2	Japan 51; Italy 24; Belgium-Luxembourg 23.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	521	588	12	Italy 188; Spain 135; Greece 98.
Artificial: Corundum	1,375	1,246	1	West Germany 864; Austria 107; Spain 92.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$2,908	$1,789	$5	Switzerland $569; West Germany $535; Belgium-Luxembourg $268.
Grinding and polishing wheels and stones	819	767	7	Italy 303; Spain 211; West Germany 72.
Asbestos, crude	9,931	9,208	--	Canada 4,658; Zimbabwe 2,871; Republic of South Africa 792.
Barite and witherite	1,216	1,466	--	Morocco 500; Spain 436; West Germany 295.
Boron materials:				
Crude natural borates	7,308	5,371	--	Turkey 4,220; Spain 736; Netherlands 392.
Oxides and acids	269	201	23	Italy 112; Belgium-Luxembourg 31; France 24.
Cement	1,850	164,738	--	Spain 136,393; Cyprus 26,789; France 934.
Chalk	6,688	8,881	--	France 6,028; Spain 1,069; United Kingdom 938.
Clays, crude	31,662	42,724	793	Spain 25,664; United Kingdom 9,427; France 5,623.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Cryolite and chiolite	61	24	--	Denmark 23; France 1.
Diamond:				
Gem, not set or strung value, thousands	$2,043	$3,258	--	Belgium-Luxembourg $1,851; United Kingdom $1,010; Netherlands $188.
Industrial stones do	$30,868	$42,451	--	Switzerland $36,605; United Kingdom $3,384; unspecified $2,451.
Diatomite and other infusorial earth	4,065	3,789	781	Spain 2,095; France 414.
Feldspar, fluorspar, related materials	3,284	754	--	France 288; United Kingdom 287; West Germany 132.
Fertilizer materials:				
Crude, n.e.s	40	23	--	Spain 17; France 6.
Manufactured:				
Ammonia	40,632	125,178	45,450	U.S.S.R. 44,146; France 12,300.
Nitrogenous	54,570	94,131	--	Romania 21,044; Libya 15,020; East Germany 13,262.
Phosphatic	450	73	--	All from France.
Potassic	57,746	63,806	--	Spain 41,330; Israel 16,675; East Germany 5,751.
Unspecified and mixed	24,187	16,909	7,350	Jordan 3,850; Morocco 3,680.
Graphite, natural	162	148	--	United Kingdom 116; West Germany 12; China 5.
Gypsum and plaster	36,257	49,163	(2)	Spain 40,009; Morocco 7,450; West Germany 1,376.
Lime	84	90	--	France 42; Spain 25; West Germany 22.
Magnesium compounds	2,686	3,152	9	United Kingdom 1,777; Spain 504; West Germany 314.
Mica:				
Crude including splittings and waste	175	168	--	United Kingdom 79; France 49; Norway 38.
Worked including agglomerated splittings	20	19	2	Belgium-Luxembourg 5; Spain 4; Switzerland 3.
Nitrates, crude	536	518	--	Chile 500; East Germany 18.
Phosphates, crude	342,282	307,611	--	Morocco 283,373; Togo 19,000; Israel 5,030.
Pigments, mineral: Iron oxides and hydroxides, processed	1,360	1,616	--	West Germany 885; Spain 526; United Kingdom 77.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$190	$422	$15	Belgium-Luxembourg $128; Switzerland $100; West Germany $49.
Synthetic do	$37	$107	--	Switzerland $63; Austria $23; Spain $9.
Pyrite, unroasted	24	22	--	West Germany 20; Spain 2.
Salt and brine	7,959	31,235	--	Spain 27,444; France 3,380; West Germany 275.
Sodium compounds, n.e.s.: Carbonate, manufactured	4	7	--	France 5; United Kingdom 1.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	46,886	3,249	--	Brazil 1,203; Republic of South Africa 907; Spain 377.
Worked	3,273	341	--	Spain 178; France 42; Belgium-Luxembourg 33.
Dolomite, chiefly refractory-grade	4,702	4,182	--	United Kingdom 1,791; Norway 851; France 615.
Gravel and crushed rock	108	143	--	Spain 43; France 30; Belgium-Luxembourg 28.
Limestone other than dimension	1,500	3,000	--	All from France.
Quartz and quartzite	11,806	286	--	West Germany 126; Finland 99; Spain 26.
Sand other than metal-bearing	8,415	12,863	10	Spain 8,221; Belgium-Luxembourg 2,345; Netherlands 2,211.
Sulfur:				
Elemental:				
Crude including native and by-product	19,016	23,088	--	France 21,563; China 1,500; United Kingdom 20.
Colloidal, precipitated, sublimed	231	67	--	Italy 20; Spain 20; United Kingdom 18.
Sulfuric acid	18,969	7,937	--	Spain 7,918; West Germany 13; United Kingdom 4.
Talc, steatite, soapstone, pyrophyllite	4,984	6,670	182	France 2,906; Belgium-Luxembourg 1,214; Norway 600.
Other:				
Crude	1,264	2,612	--	Spain 1,841; United Kingdom 269; France 179.
Slag and dross, not metal-bearing	21,097	20,017	--	Belgium-Luxembourg 20,014; Spain 2; United Kingdom 1.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	613	814	71	Spain 733; Belgium-Luxembourg 10.
Carbon: Carbon black	1,611	1,022	12	West Germany 328; Spain 227; United Kingdom 206.
Coal:				
Anthracite and bituminous thousand tons	1,469	1,892	1,030	Republic of South Africa 361; United Kingdom 222.
Lignite including briquets do		(2)	--	
Coke and semicoke do	62	46	--	United Kingdom 11; Spain 3; unspecified 25.
Peat including briquets and litter	2,957	3,596	--	West Germany 2,198; U.S.S.R. 500; Netherlands 337.
Petroleum:				
Crude thousand 42-gallon barrels	52,176	60,493	--	Iraq 8,839; Saudi Arabia 7,497; United Arab Emirates 7,431.
Refinery products:				
Liquefied petroleum gas do	3,159	3,620	18	United Kingdom 2,047; France 439; Belgium-Luxembourg 370.
Gasoline do	5,005	4,913	--	Spain 1,544; Kuwait 985; Algeria 619.
Mineral jelly and wax do	19	19	--	Spain 10; West Germany 3; United Kingdom 2.
Kerosene and jet fuel do	273	24	2	Spain 12; Netherlands 3.
Distillate fuel oil do	658	698	119	Spain 256; Italy 179.
Lubricants do	332	289	2	Italy 91; Netherlands 47; France 37.
Residual fuel oil do	2,104	9,473	155	France 4,307; Spain 3,783; Netherlands 609.
Bitumen and other residues do	294	362	--	Spain 336; Netherlands 14; West Germany 7.
Bituminous mixtures do	57	35	--	Spain 27; United Kingdom 4; France 3.
Petroleum coke do	373	79	78	West Germany 1.

[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Copper.—Sociedade Mineira de Neves-Corvo S.A.R.L. (Somincor) sold the first ore from the Neves-Corvo Mine in southeastern Portugal in late 1987. The 7,000 tons of copper ore was purchased by Noranda Mines Ltd.'s Gaspé smelter in Quebec, Canada, for direct smelting in its reverberatory furnace. If Noranda were satisfied with the initial shipment, Somincor planned to sell the Canadian concern quantities from stockpiles it had reportedly built up.

Although Somincor negotiated with Boliden Minerals AB (Sweden), Noranda (Canada), Outukumpu Oy (Finland), and Rio Tinto Minera S.A. (Spain), it reached no long-term smelter agreements. The flash smelters used by most European producers are not capable of handling the untreated Neves-Corvo ore. Furthermore, the 4,000-ton-per-day, 450,000-ton-per-year, 25% copper concentrator at Neves-Corvo will not function until September 1988.

Despite this, however, development of the underground mine was well advanced by yearend 1987, with full production of 1.3 million tons per year scheduled to begin by 1990. Progress was facilitated by a $210 million loan approved by the European Investment Bank, repayable over 17 years. The infusion of funds was sufficient to meet just under 50% of development costs. Somincor, owned 51% by Empresa de Desenvolvimento Mineiro do Alentejo and 49% by RTZ Metals Group of the United Kingdom, raised the remaining capital privately.

As work continued on the Neves-Corvo copper project, the company ordered from Sala, a Swedish manufacturer, four large air pressure filters that can dewater the fine copper concentrate to 9% moisture at a maximum rate of more than 100 tons per hour. Developed in conjunction with Boliden in Sweden and Kurita Machinery in Japan, the filters are lightweight. They operate over a short cycle time, involve a very simple cloth change, and have low operating costs. In addition, the filters can be computer controlled.

In the latter part of 1987, Somincor ordered five grinding mills valued at more than $4 million from Allis-Chalmers Energy and Minerals Systems Co. for use at Neves-

Corvo. Included in the package were one 3.8-meter-diameter rod mill and four 4.1-meter-diameter ball mills.

It was expected that some of the equipment would be initially installed between the Corvo and Neves ore bodies, where the preponderant development work was taking place. Corvo and Neves, along with Graca and Zambujal, have four sulfide deposits defined as having minable reserves of copper ore of approximately 25 million tons at a head grade of 8%. The ore bodies lie within 5 kilometers of each other. Quantities of complex zinc-copper ore, complex zinc ore, and minor reserves of silver and tin have also been identified.

Pirites Alentajanas S.A.R.L. announced it would undertake an expansion program that would triple the annual output of complex copper, lead, and zinc ore from its two mines at Aljustrel before 1990. Annual production is scheduled to rise from 300,000 tons to more than 1 million tons. Ore grades average 3.06% zinc, 1.1% lead, and 0.88% copper. Production of metal in concentrate is projected to amount to 27,500 tons of zinc, 8,400 tons of lead, and 6,300 tons of copper. Empresa de Desenvolvimento Mineiro, the state holding company, is the dominant shareholder in Pirites Alentajanas.

Ferroalloys.—Fornos Eletricos Companhia Portuguesa de Lisboa, the Portuguese ferrosilicon producer, suspended its trading agreements with the West German steel group Thyssen Schulte AG and with Bermuda's Hofflinghouse after announcing it had sold the last of its ferrosilicon stocks. The company curtailed production when power at the Nelas works was turned off. Fornos would not agree to a rate increase for electricity stipulated by the state-owned utility, Electricidade de Portugal.

Fornos reportedly indicated that the costs of restarting production may be prohibitive. Its ferrosilicon stocks have been depleted, and securing a continuing inexpensive supply of electrical power in the volatile Portuguese power market is difficult.

Iron and Steel.—In the wake of Portugal's accession to the EEC, a number of significant developments occurred in Portugal's iron and steel industry. First, the EEC Commission authorized Portugal to limit its imports of Spanish steel products. In 1987, Spain was restricted to exporting 6,500 tons of wire rod, 11,000 tons of bars, and 1,400 tons of sections.

During the latter part of the year, the two nations reached an accord wherein, for 1988, Spain will export 6,000 tons of wire rod, 12,000 tons of rebars, and 6,000 tons of sections. Under the bilateral arrangement, ceilings will rise, permitting Spain to sell Portugal 15,000 tons of wire rod, 55,000 tons of rebars, and 15,000 tons of sections by 1991. During early 1987, the apparent effect of import quotas, a strengthening of the Portuguese construction industry, and an aggressive sales policy pursued by Portugal's state-owned Siderurgia Nacional S.A.R.L. was to raise the value of orders for certain products to the highest level ever recorded by that company.

At the same time, EEC pressure caused the steelmaker to phase out, by 1991, electric arc steelmaking at its main integrated plant at Seixal near Lisbon, and to scrap expansion plans for that site that had been formed over several years. Instead, Siderurgia Nacional redirected its attention to improving product quality and productivity.

The company increased the efficiency of Seixal's 400,000-ton-per-year No. 1 blast furnace by curbing coke and energy consumption. Also, it planned to replace the 150,000-ton-per-year four-strand Danieli billet caster, in operation since 1970, with a 400,000-ton-per-year six-strand Schloemann-Siemag unit, capable of increasing continuous casting production by 80%. In addition, the continuous casting and wire rod mill facilities at the company's 200,000-ton-per-year Maia minimill near Oporto were overhauled at yearend 1987.

Capital for the approximately $106 million modernization program was to be raised, in part, by the sale of equipment, uninstalled as a result of the aforementioned termination of expansion plans. Offered were a 1-million-ton-per-year blast furnace, two 120-ton LD/LBE converters, two six-strand continuous billet casters, and a 576,000-ton-per-year twin-strand wire rod mill.

INDUSTRIAL MINERALS

In 1987, the recovery continued that began in the Portuguese cement industry in 1986. Largely responsible for the improvement was a surge in domestic consumption by the building industry. At the same time, the dimension stone sector industry maintained its status as among the most important in terms of value.

MINERAL FUELS

Portugal continued to rely heavily on imported energy sources. Domestic output of coal, hydropower, and uranium was rela-

tively low. Notable was a 7.5% increase in oil consumption, despite greater use of coal in electricity generating units at Sines, approximately 100 kilometers south of Lisbon. There work continued on the third of a four-unit coal-fired powerplant. The fourth is scheduled for completion by yearend 1989.

Of considerable importance was an agreement between Portugal and Angola, reached in late 1987. The terms called for Angola to supply crude oil to Portugal as a means of debt repayment. Specifically, four 125,000-ton ships are to deliver, on a yearly basis, Angolan crude to Portugal's state-owned oil company, Petrogal, beginning in 1988.

The annual supply of about 3.6 million barrels of crude petroleum from Sonangola, Angola's Government-run oil enterprise, would represent 20% of Petrogal's annual purchases and provide a strategic reserve of 2.1 million barrels of crude at Sines. Simultaneously Angola's petroleum exports generated by this arrangement would permit that nation to honor its debts to Portuguese companies, particularly those obligations not included under various agreements between the central banks of the two countries.

Within the framework of Portugal's continuing integration into the EEC, price subsidies were eliminated for certain petroleum products, drawn largely from gasoline taxes. At the same time, a new cost-based pricing structure for oil products was enacted and applied. To ensure adaptation of those expenditures to European levels by 1993, a cost-moderating factor for refining was added.

With respect to oil marketing and sales, volume quotas allocated to private companies were abolished. Furthermore, Petrogal will relinquish a share of its quota on each product, each year over the next 6 years, as part of the transition to a free oil market.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Portuguese escudos (Esc.) to U.S. dollars at the rate of Esc.140.882=US$1.00, the average exchange rate in 1987.

The Mineral Industry of Romania

By Walter G. Steblez[1]

In 1987, Romania's mineral industry continued to produce modest amounts of bauxite, copper, iron, lead, manganese, and zinc ores. However, the production costs of these commodities continued to escalate owing to depletion of higher grade reserves and expanded production of lower rank ores. To an increasing degree, Romania has had to import these commodities for its industrial needs. The output of petroleum also remained on a declining trend because of dwindling reserves. The country, once among the leading world petroleum producers, had to import substantial amounts of crude petroleum to meet the needs of its refineries. In 1987, Romania's centrally planned economy continued to be affected by shortfalls in industrial production and growth in national income. The planned growth of industrial production fell short by 3.9%; that of national income by about 3.7%. During 1987, major capital outlays continued for development of the Rosia Poieni copper-molybdenum mining and beneficiation complex and the Cernavoda nuclear powerplant. In midyear, Petromar, Romania's offshore petroleum exploration company, claimed the startup of petroleum production in the Black Sea.

Government Policies and Programs.—The rapid repayment of Romania's convertible currency foreign debt remained the central Government economic policy in 1987. To meet this objective, Romania carried out a program of import reduction from 1981 to 1987, while accelerating exports of all goods and commodities marketable on a hard-currency basis. Steel semimanufactures allegedly were sold below production costs. Also, exports of agricultural goods, despite the needs for domestic consumption, resulted in food shortages that contributed to dislocations in the industrial sector. Although Romania claimed to be a leading world producer and exporter of mining equipment, the country's mining industry was perennially short of spare parts for its capital equipment. Mining enterprises were often supplied with spare parts that could not be used in repair and maintenance, and stockpiles of these materials overcrowded the industry's storage facilities.[2] As in other centrally planned economy countries, Romania set centrally planned production targets in terms of gross weight output indicators that often resulted in the production of goods that were not always suited to the needs of the consumer.[3] Specific targets were not provided in Romania's central economic plan for 1988 for industrial durables, fossil fuels, iron and steel, and nonferrous metals.[4] Instead, the plan focused on the need to reduce industry's consumption of fuels and minerals and to raise the output of crude petroleum, surface-mined coal, lignite, nonferrous ores, and coal-generated electrical power. The plan also stressed the need to increase the output of goods earmarked for export.

As in earlier years, the 1988 planned targets for growth of national income and industrial production were unrealistically high and, compared with those of 1987, were to grow by 9.5% and 11.5%, respectively.

PRODUCTION

Romania's mineral industry was state-owned and operated. Wages and prices continued to be set administratively, and market values were used only to determine hard-currency export prices for mineral and fuel commodities. Apart from shortages of spare parts in the mining and processing sectors, production declines for many mineral commodities were attributable to severe fuel and energy shortages owing to drought, which resulted in hydroelectric power reductions and a decline in domestic petroleum production.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Bauxite, gross weight[e]	650,000	620,000	600,000	600,000	600,000
Alumina, calcined, gross weight	512,000	552,000	548,000	555,000	500,000
Ingot including alloys:					
Primary	223,000	244,000	247,000	235,000	250,000
Secondary	21,000	20,000	18,000	16,000	15,000
Total	244,000	264,000	265,000	269,000	265,000
Bismuth, mine output, Bi content[e]	80	80	80	80	80
Cadmium, smelter[e]	80	75	75	75	75
Copper:[e]					
Mine output, Cu content	27,000	25,000	26,000	27,000	26,000
Smelter:					
Primary	34,000	32,000	[3]32,963	32,000	30,000
Secondary	6,000	6,000	7,000	7,000	8,000
Total	40,000	38,000	39,963	39,000	38,000
Refined, primary and secondary[e]	47,000	45,000	46,000	43,000	42,000
Gold, mine output, Au content[e] troy ounces	65,000	65,000	65,000	60,000	60,000
Iron and steel:					
Iron ore:					
Gross weight thousand tons	1,987	1,916	2,287	2,431	2,400
Content (26% Fe) do	517	498	595	632	624
Metal:					
Pig iron do	8,190	9,557	9,212	9,329	9,200
Steel, crude do	12,593	14,437	13,975	14,276	14,000
Ferroalloys:[e]					
Ferrochromium	42,000	45,000	44,000	44,000	42,000
Ferromanganese	80,000	87,000	80,000	82,000	81,000
Ferrosilicon	48,000	52,000	50,000	51,000	50,000
Silicomanganese	38,000	41,000	39,000	40,000	39,000
Silicon metal	3,800	4,100	3,800	4,500	4,500
Semimanufactures:					
Castings and forgings, finished[e] thousand tons	1,100	1,200	1,200	1,300	1,400
Pipes and tubes do	1,411	1,507	1,513	1,565	1,600
Rolled products do	9,179	10,329	9,900	10,207	11,300
Lead:					
Mine output, Pb content[e]	30,000	30,000	30,000	28,000	28,000
Metal, smelter:					
Primary[e]	40,000	35,900	38,600	[r]35,000	35,000
Secondary[e]	[3]9,298	10,000	10,000	[r]16,500	14,000
Total	49,298	45,900	48,600	51,500	49,000
Manganese:[4]					
Ore, gross weight[e] thousand tons	312	264	250	250	250
Concentrate:					
Gross weight do	78	66	68	67	68
Mn content[e] do	23	20	19	19	19
Silver, mine output, Ag content[e] thousand troy ounces	820	810	810	800	750
Zinc:[e]					
Mine output, Zn content	45,000	44,000	43,000	43,000	41,000
Metal, smelter, primary and secondary	42,000	41,000	40,000	39,000	37,000
INDUSTRIAL MINERALS					
Barite[e]	78,000	75,000	75,000	75,000	72,000
Cement, hydraulic thousand tons	13,968	14,016	12,238	14,216	14,300

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Clays:[e]					
Bentonite	177,000	180,000	180,000	185,000	180,000
Kaolin	410,000	410,000	410,000	410,000	400,000
Diatomite[e]	290,000	300,000	290,000	300,000	280,000
Feldspar[e]	85,000	85,000	86,000	86,000	82,000
Fluorspar[e]	20,000	20,000	20,000	20,000	18,000
Graphite[e]	12,500	12,500	12,000	12,000	12,000
Gypsum[e]	1,630	1,650	1,620	1,600	1,600
Lime thousand tons	3,623	3,848	3,717	3,959	4,000
Nitrogen: N content of ammonia do	2,727	2,861	2,880	3,041	3,000
Pyrites, gross weight[e] do	930	930	930	900	900
Salt:					
Rock do	1,838	1,874	[e]1,900	[e]2,000	2,000
Other do	2,758	3,000	[e]3,119	3,355	3,400
Total do	4,596	4,874	5,019	5,355	5,400
Sand[e] do	2,500	2,500	2,500	2,500	2,500
Sodium compounds, n.e.s.:					
Caustic soda do	745	805	814	846	850
Sodium carbonate, manufactured, 100% Na_2CO_3 basis do	788	912	836	895	890
Sulfur:[e]					
S content of pyrites do	200	200	200	150	150
Byproduct, all sources do	150	150	150	140	130
Total do	350	350	350	290	280
Sulfuric acid do	1,941	1,915	1,835	1,971	2,000
Talc[e]	65,000	66,000	65,000	64,000	60,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	101,166	106,900	108,593	105,802	106,000
Coal:					
Run-of-mine:					
Anthracite and bituminous thousand tons	10,629	10,653	10,472	11,074	11,000
Brown do	773	827	834	858	900
Lignite do	37,357	36,319	38,513	39,400	40,000
Total do	48,759	47,799	49,819	51,332	51,900
Washed (produced from above):					
Anthracite and bituminous:					
For coke and semicoke production do	2,618	2,903	2,963	3,276	3,300
For other uses do	5,175	5,555	5,694	5,420	5,400
Brown do	731	782	784	810	800
Lignite do	35,998	35,040	37,140	38,012	38,000
Total do	44,522	44,280	46,581	47,518	47,500
Coke:					
Metallurgical do	4,268	4,849	4,743	5,088	5,100
Other do	[e]450	[e]450	439	582	550
Total do	4,718	5,299	5,182	5,670	5,650
Fuel briquets (from brown coal)[e] do	750	750	750	750	750
Gas, natural:					
Gross:					
Associated million cubic feet	366,813	387,437	413,464	445,247	400,000
Nonassociated do	978,888	991,743	960,417	945,126	945,000
Total do	1,345,701	1,379,180	1,373,881	1,390,373	1,345,000
Marketed[e] do	1,100,000	1,127,000	1,126,000	1,120,000	1,120,000
Petroleum:					
Crude:					
As reported thousand tons	11,593	11,453	10,718	10,125	10,000
Converted thousand 42-gallon barrels	87,643	86,585	81,028	76,545	75,000
Refinery products[e] do	[r]161,700	[r]167,300	[r]169,300	185,500	184,000

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

[1]Includes data available through Sept. 16, 1988.

[2]In addition to the commodities listed, antimony, asbestos, 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]Estimated series were based on published data on concentrate production.

TRADE

Despite failure to meet the planned foreign trade turnover for 1987, Romania reported a $2.8 million hard-currency surplus with market economy countries. Although Romania continued to barter trade extensively with developing and several developed market economy countries to obtain badly needed iron and nonferrous ores, commercial relations with the Council for Mutual Economic Assistance (CMEA) remained the cornerstone of the country's mineral trade. Within the CMEA, the Soviet Union played a dominant role in supplying Romania with fuels and mineral commodities. In 1987, about 30% of Romania's trade was with the U.S.S.R. During the year, the U.S.S.R. supplied Romania with 2.5 million tons of bituminous coal, 4.7 million tons of crude petroleum, over 138,000 tons of ferroalloys, 4.8 million tons of iron ore, 3.4 million tons of iron ore pellets, 115 billion cubic feet of natural gas, about 400,000 tons of rolled iron and steel, and over 200,000 tons of potash-based fertilizer.[5] To help pay for these deliveries, Romania participated in mining and oil and gas development projects in the U.S.S.R., mainly by providing labor and oilfield equipment. Commercial exchanges with the U.S.S.R. for the 1986-90 period were planned to grow by 65%, compared with the 1981-85 5-year plan. Romania was to continue to participate in mineral and mineral fuel development projects in the Soviet Union in exchange for raw materials. Romania's mineral trade with the United States was largely limited to Romanian imports of bituminous coal and exports of petroleum products.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	--	60	--	All to Italy.
Ash and residue containing aluminum	--	10	--	All to Spain.
Metal including alloys:				
Scrap	2,742	2,184	--	Italy 2,054; West Germany 79; Spain 51.
Unwrought	[2]139,100	116,727	15,927	Italy 22,929; France 17,280.
Semimanufactures	8,220	16,713	6,343	Japan 6,140; France 1,839.
Chromium: Oxides and hydroxides	204	349	240	France 39; Japan 34.
Copper:				
Matte and speiss including cement copper	--	18	--	All to Greece.
Metal including alloys:				
Scrap	--	237	--	All to West Germany.
Unwrought	77	18	--	All to Italy.
Semimanufactures	39	27	2	West Germany 19; France 6.
Gold:				
Waste and sweepings value, thousands	$137	$12	--	All to West Germany.
Metal including alloys, unwrought and partly wrought do.	$14	$13	--	Do.
Iron and steel: Metal:				
Scrap	173	68	--	Austria 59; Yugoslavia 9.
Pig iron, cast iron, related materials	418	440	--	West Germany 420; Italy 20.
Ferroalloys:				
Ferrochromium	--	811	--	All to Netherlands.
Ferromanganese	1,000	6,000	--	NA.
Ferrosilicomanganese	5,602	781	--	West Germany 581; Netherlands 200.
Ferrosilicon	--	256	--	Netherlands 181; West Germany 75.
Unspecified	6,099	75	--	All to France.
Steel, primary forms	84,182	69,458	--	Yugoslavia 43,046; United Kingdom 13,510; Japan 6,984.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel: Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections ____ thousand tons__	1,498	1,409	__	Poland 81; West Germany 70; unspecified 1,139.
Universals, plates, sheets do____	872	1,052	60	Japan 153; West Germny 60; unspecified 619.
Hoop and strip_____do____	1	(3)	__	Mainly to Finland.
Rails and accessories___do____	(3)	1	__	All to Greece.
Wire_____do____	95	96	__	West Germany 5; Yugoslavia 1; unspecified 88.
Tubes, pipes, fittings ___do____	2410	503	22	Poland 103; West Germany 10; unspecified 337.
Castings and forgings, rough do____	6	4	(3)	West Germany 3.
Lithium: Oxides and hydroxides_____	73	__		
Magnesium: Metal including alloys, semimanufactures _____	__	62	__	All to United Kingdom.
Nickel: Metal including alloys:				
Unwrought _____	__	21	__	All to Austria.
Semimanufactures_____	3	1	__	All to Italy.
Platinum-group metals: Waste and sweepings_____ value, thousands__	__	$78	__	West Germany $41; Italy $37.
Silver:				
Waste and sweepings _____do____	$14	__		
Metal including alloys, unwrought and partly wrought _____do____	$564	$1,103	__	United Kingdom $714; Yugoslavia $376; West Germany $13.
Tin: Oxides _____	18	__		
Tungsten:				
Ore and concentrate_____	__	2	__	All to Denmark.
Metal including alloys, all forms ___	1	8	__	All to West Germany.
Zinc: Metal including alloys:				
Unwrought _____	150	50	__	Do.
Semimanufactures_____	__	39	__	All to Morocco.
Other:				
Ashes and residues_____	58	87	__	Italy 46; United Kingdom 41.
Base metals including alloys, all forms	214,661	6,132	__	All to Poland.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc _____	18	__		
Artificial: Corundum _____	76	220	__	All to West Germany.
Dust and powder of precious and semiprecious stones including diamond value, thousands__	$999	$560	$235	Belgium-Luxembourg $314; West Germany $10.
Grinding and polishing wheels and stones _____	1	38	__	All to France.
Barite and witherite_____	220	440	__	Do.
Boron materials: Oxides and acids ____	99	50	__	All to Italy.
Cement_____ thousand tons__	22,477	146	__	Hungary 135; Norway 6; United Kingdom 3.
Clays, crude:				
Kaolin _____	__	18	__	All to Italy.
Unspecified _____	6	150	__	Do.
Diamond:				
Gem, not set or strung value, thousands__	$3	__		
Industrial stones _____do____	$84	$975	__	All to Belgium-Luxembourg.
Fertilizer materials: Manufactured:				
Ammonia _____ thousand tons__	12	4	__	Yugoslavia 3.
Nitrogenous_____do____	21,347	1,204	536	West Germany 169; France 116.
Phosphatic _____do____	33	108	__	U.S.S.R. 86; Yugoslavia 21.
Unspecified and mixed ____do____	23,294	262	__	Thailand 81; Denmark 72; Yugoslavia 27.
Gypsum and plaster _____	12,225	12,283	__	All to Hungary.
Lime _____	31,965	__		
Phosphorus, elemental _____	__	159	__	Italy 109; Switzerland 50.
Pigment, mineral:				
Natural, crude _____	__	2	__	All to Denmark.
Iron oxides and hydroxides, processed	__	5	__	All to Greece.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Precious and semiprecious stones other than diamond, synthetic value, thousands	$53	$14	--	All to Belgium-Luxembourg.
Salt and brine	671,749	702,455	--	Hungary 464,345; Yugoslavia 238,110.
Sodium compounds, n.e.s.: Carbonate, manufactured	[2]471,800	178,814	--	Hungary 49,137; Yugoslavia 45,861; Thailand 33,400.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	11	108	--	Hungary 43; Italy 34; Switzerland 31.
Worked	11,310	18,899	--	West Germany 18,161; Switzerland 518; Austria 212.
Sand other than metal-bearing	--	2	--	All to Jordan.
Other: Crude	159	775	--	All to West Germany.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	[2]21,000	5,780	--	Czechslovakia 2,670; Bulgaria 2,100; Yugoslavia 743.
Coal: Anthracite and bituminous	--	15	--	All to Greece.
Gas, natural: Gaseous million cubic feet	--	2	--	All to Hungary.
Peat including briquets and litter	--	404	--	Austria 299; Italy 84; France 21.
Petroleum:				
Crude thousand 42-gallon barrels	--	415	394	Netherlands 21.
Refinery products:				
Liquefied petroleum gas do	704	--		
Gasoline do	[2]33,150	14,572	8,882	West Germany 1,557; Spain 1,052.
Mineral jelly and wax do	[2]16	7	--	Thailand 6.
Kerosene and jet fuel do	27	127	--	West Germany 74; Belgium-Luxembourg 45; Hungary 8.
Distillate fuel oil do	[2]20,664	27,004	957	Italy 13,374; France 6,964; West Germany 4,415.
Lubricants do	[2]1,523	8,108	7,866	West Germany 112; Austria 101.
Residual fuel oil do	[2]17,086	5,982	1,542	Italy 2,149; Sweden 716.
Bitumen and other residues do	12	(3)	--	All to Switzerland.
Petroleum coke do	[2]1,000	104	--	All to Italy.

[p]Preliminary. NA Not available.

[1]Table prepared by Jozef Plachy. Owing to a lack of official trade data published by Romania, this table should not be taken as a complete presentation of this country's mineral trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries.

[2]Official Trade Statistics of Romania.

[3]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	274,564	260,518	--	Yugoslavia 225,646; Hungary 34,872.
Oxides and hydroxides	41,158	42,164	--	Yugoslavia 15,000; Hungary 11,755; Greece 10,000.
Metal including alloys:				
Unwrought	2,622	1,000	--	All from Hungary.
Semimanufactures	1,687	411	--	United Kingdom 215; Hungary 72; Austria 66.
Chromium:				
Ore and concentrate	[2]101,400	272	--	All from West Germany.
Oxides and hydroxides	--	6	--	All from United Kingdom.
Metal including alloys, all forms	110	45	--	Do.
Cobalt: Metal includng alloys, all forms	31	15	--	United Kingdom 9; West Germany 6.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Columbium and tantalum: Metal including alloys, all forms:				
Columbium (niobium)	--	1	--	All from West Germany.
Tantalum	--	1	1	
Copper:				
Oxides and hydroxides	25	--		
Metal including alloys:				
Scrap	5,364	6,537	--	All from Chile.
Unwrought	8,860	1,000	--	All from Spain.
Semimanufactures	7,761	6,576	--	Poland 5,845; West Germany 406; Italy 119.
Gold: Metal including alloys, unwrought and partly wrought value, thousands	$151	$306	--	Switzerland $265; West Germany $39; Japan $2.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite -- thousand tons	[2]15,207	9,063	--	All from U.S.S.R.
Metal:				
Scrap	12	7	--	All from France.
Pig iron, cast iron, related materials	[2]117,400	100,000	--	NA.
Ferroalloys:				
Ferrochromium	711	587	--	Italy 358; Yugoslavia 120; West Germany 109.
Ferromanganese	37,000	60,000	--	NA.
Ferromolybdenum	20	--		
Ferrosilicomanganese	20,195	19,979	--	All from U.S.S.R.
Silicon metal	185	--		
Unspecified	[2]87,034	81,434	--	NA.
Steel, primary forms	281,000	309,000	--	NA.
Semimanufactures:				
Bars, rods, angles, shapes, sections -- thousand tons	249	221	(3)	Czechoslovakia 15; Hungary 14; unspecified 188.
Universals, plates, sheets do	108	113	--	Bulgaria 19; Portugal 9; unspecified 56.
Hoop and strip do	9	7	(3)	West Germany 5; Hungary 1.
Rails and accessories do	100	85	--	NA.
Wire do	9	7	--	West Germany 1; Yugoslavia 1; unspecified 5.
Tubes, pipes, fittings do	[2]44	33	--	Japan 2; West Germany 1; unspecified 26.
Castings and forgings, rough do	1	1	(3)	NA.
Lead:				
Ore and concentrate	12,709	7,829	--	Spain 4,993; Ireland 2,486; Yugoslavia 350.
Oxides	1,135	491	--	Italy 471; France 20.
Metal including alloys, unwrought	5,320	--		
Magnesium: Metal including alloys, semimanufactures	53	45	--	West Germany 30; France 15.
Manganese:				
Ore and concentrate, metallurgical-grade	225,000	196,000	--	NA.
Metal including alloys, all forms	31	--		
Mercury 76-pound flasks	493	87	--	All from Netherlands.
Molybdenum:				
Ore and concentrate	--	24	--	All from West Germany.
Metal including alloys, all forms	3	1	--	All from France.
Nickel:				
Matte and speiss, Ni content	351	--		
Metal including alloys:				
Scrap	10	--		
Unwrought	[2]10,900	64	--	Finland 50; United Kingdom 14.
Semimanufactures	228	175	--	West Germany 110; Italy 29; United Kingdom 21.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$625	$2,238	--	United Kingdom $2,140; Switzerland $66; France $26.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Silver: Metal including alloys, unwrought and partly wrought ____do____	$159	$138	--	West Germany $74; Switzerland $40; United Kingdom $24.
Tin: Oxides	17	--		
Titanium:				
Ore and concentrate	6,425	4,975	--	All from Netherlands.
Oxides	1,559	892	--	West Germany 687; France 110; United Kingdom 91.
Metal including alloys, all forms	9	10	--	United Kingdom 7; France 1; Italy 1.
Tungsten:				
Oxides and hydroxides	--	50	--	France 30; West Germany 20.
Metal including alloys, all forms	74	20	--	West Germany 13; France 5; Portugal 1.
Zinc:				
Ore and concentrate	1,880	7,700	--	All from Spain.
Oxides	5,186	3,746	--	France 3,202; Yugoslavia 544.
Blue powder	NA	435	--	West Germany 260; France 175.
Metal including alloys:				
Unwrought	--	2,444	--	All from Poland.
Semimanufactures	403	107	--	Poland 104; Switzerland 2; Italy 1.
Zirconium:				
Ore and concentrate	898	595	--	All from West Germany.
Metal including alloys, all forms	1	--		
Other:				
Ores and concentrates	4	--		
Oxides and hydroxides	18	64	--	West Germany 62; Netherlands 2.
Base metals including alloys, all forms	109	105	(3)	West Germany 93; Sweden 7; Austria 5.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	--	40	--	All from Greece.
Artificial: Corundum	9,043	1,693	--	Yugoslavia 4,831; Hungary 4,612; Japan 1,200.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$228	$39	--	United Kingdom $20; Belgium-Luxembourg $19.
Grinding and polishing wheels and stones	814	700	(3)	Italy 250; West Germany 122; Netherlands 75.
Asbestos, crude	733	1,152	--	Italy 1,096; Canada 54; Switzerland 2.
Barite and witherite	3,750	11,295	--	All from Yugoslavia.
Boron materials: Crude natural borates	19,000	--		
Cement	12	1	--	All from Italy.
Chalk	--	23	--	All from West Germany.
Clays, crude:				
Bentonite	16	--		
Kaolin	4,293	4,840	--	United Kingdom 4,818; West Germany 22.
Unspecified	29,812	350	--	All from West Germany.
Diamond:				
Gem, not set or strung value, thousands	$49	--		
Industrial stones ____do____	$3,965	$4,032	$30	Belgium-Luxembourg $2,293; United Kingdom $1,709.
Diatomite and other infusorial earth	1,072	1,093	--	France 933; Iceland 93; Austria 64.
Fertilizer materials: Manufactured:				
Ammonia	--	1,906	--	All from Italy.
Nitrogenous	209	11	--	All from West Germany.
Potassic	[2]831,731	629,908	--	U.S.S.R. 397,700; East Germany 229,200; West Germany 6.
Unspecified and mixed	--	2,220	--	All from Italy.
Fluorspar	12,585	4,219	--	Italy 2,200; Spain 2,019.
Graphite, natural	65	26	--	All from West Germany.
Gypsum and plaster	--	20	--	All from United Kingdom.
Iodine	--	16	--	All from Belgium-Luxembourg.
Magnesium compounds	66,766	24,623	--	Czechoslovakia 24,000; Yugoslavia 504; France 85.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Mica:				
Crude including splittings and waste	--	30	--	All from Belgium-Luxembourg.
Worked including agglomerated splittings	9	7	--	France 5; Austria 1; Italy 1.
Phosphates, crude --- thousand tons	[2]2,404	1,315	91	Morocco 634; Jordan 590.
Phosphorus, elemental	1,625	1,578	--	All from U.S.S.R.
Pigments, mineral: Iron oxides and hydroxides, processed	335	95	--	All from Japan.
Precious and semiprecious stones other than diamond, synthetic value, thousands	$26	$29	--	Japan $20; United Kingdom $6; Belgium-Luxembourg $3.
Pyrite, unroasted	70,284	--		
Salt and brine	49	30	--	All from West Germany.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	--	30	--	Sweden 20; Italy 10.
Worked	89	24	--	France 23; West Germany 1.
Gravel and crushed rock	268	150	--	France 114; Italy 19; Yugoslavia 17.
Quartz and quartzite	205	16	--	All from West Germany.
Sand other than metal-bearing	--	24	--	All from Netherlands.
Sulfur:				
Elemental:				
Crude including native and byproduct	[2]392,900	163,640	--	Poland 159,000; Greece 2,500; West Germany 2,140.
Colloidal, precipitated, sublimed	--	312	--	All from West Germany.
Dioxide	722	--		
Sulfuric acid	7,103	2,715	--	Hungary 2,663; West Germany 51; Switzerland 1.
Talc, steatite, soapstone, pyrophyllite	334	--		
Other:				
Crude	5,154	1,992	--	Italy 675; Greece 500; West Germany 452.
Slag and dross, not metal-bearing	--	38	--	France 24; Netherlands 14.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	13	9	--	All from West Germany.
Carbon black	46	8	--	Netherlands 6; United Kingdom 2.
Coal: Anthracite and bituminous thousand tons	[2]6,049	4,062	1,008	Poland 1,740; Australia 883.
Coke and semicoke do	[2]1,898	1,175	--	Japan 753; Poland 97; United Kingdom 76.
Gas, natural: Gaseous million cubic feet	[2]65	--		
Petroleum:				
Crude thousand 42-gallon barrels	[2]106,770	426	--	All from Tunisia.
Refinery products:				
Gasoline ---42-gallon barrels	96,884	94,121	--	Italy 93,653; West Germany 459; United Kingdom 9.
Mineral jelly and wax --do	86	3,101	--	Hungary 2,920; United Kingdom 126; Austria 31.
Kerosene and jet fuel---do	519	275,126	--	Italy 275,079; Yugoslavia 39; United Kingdom 8.
Distillate fuel oil -----do	2,044	3,215	--	Austria 2,514; Greece 358; West Germany 343.
Lubricants ---------do	27,720	25,190	473	West Germany 10,619; Italy 10,241; United Kingdom 1,757.
Residual fuel oil------do	160	298,028	--	All from Italy.
Bituminous mixtures---do	--	61	--	All from Yugoslavia.
Petroleum coke ------do	104,500	148,500	--	All from Japan.

[p]Preliminary. NA Not available.

[1]Table prepared by Jozef Plachy. Owing to a lack of official trade data published by Romania, this table should not be taken as a complete presentation of this country's mineral trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries.

[2]Official Trade Statistics of Romania.

[3]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Copper.—Development of the Rosia Poieni copper mining and beneficiation complex in the Apuseni Mountains continued to be one of the main investment projects in the mineral industry. Construction of the concentrator was not completed during the year as planned. The project's startup was rescheduled for 1988. When fully operational, the complex would produce about 9 million tons of ore per year. At the Moldova Noua copper mine in the Caras-Severin District a domestically designed molybdenum recovery unit was reportedly put on-stream in September.

Iron and Steel.—The Iasi ironworks and steelworks announced the installation of a 16,500-ton-per-year welded tube mill. All of the equipment, including the automated control system, was domestically produced. The steelworks also introduced three new grades of steel designed chiefly for use in the manufacture of cast parts for mining equipment and rings for heavy bearings. At Hirsova, near Constanta, construction of a new steel cable and wire plant was started. The plant was designed to produce 25,000 tons per year of steel cable and 20,000 tons per year of wire, ranging from 0.2 to 1.0 millimeters in diameter.

Lead and Zinc.—Romania continued to mine low-grade lead and zinc ores in the Baia Mare area. Mine output of lead and zinc had been on a declining trend in recent years, requiring substantial imports of concentrates from abroad. Approximately 30,000 tons of zinc and 10,000 tons of lead concentrates were imported from Iran during the year. Concentrates were smelted at the Uxina Chimica Metalurgia Imperial Smelter in Copsa Mica.

INDUSTRIAL MINERALS

Romania's production of barite, bentonite, diatomite, feldspar, graphite, gypsum, kaolin, and limestone was sufficient to meet most domestic needs. Industrial minerals were mined throughout the country at about 60 deposits, the total production of which reportedly increased about sixfold from 1967 to 1987. During the 1986-90 5-year plan, new quartz and diatomite deposits were to be put into operation. Romania also produced synthetic diamonds at the Dacia synthetic diamond plant in Bucharest.

MINERAL FUELS

Coal.—A new longwall system was put into operation at the Motru-Vestmin Mine thereby adding 800 tons of output per day. Most of Romania's coal was substandard and caused extensive problems at coal-fired electric-power stations by clogging filters and damaging furnaces. The country continued to experience severe power shortages, especially during the winter months. In mid-1987, Romania negotiated with the government of Queensland, Australia, to enter into a long-term contract for the purchase of 3 million tons per year of Australian coking coal in exchange for steel products and equipment such as railway rolling stock.

Petroleum.—The chief event in an industry marked by rapidly declining production was the startup in May of Petromar's offshore "Gloria" platform. The petroleum was pumped through a 50-mile pipeline to the Midia Novodari refinery for processing. Romania was the first country to produce oil from the Black Sea shelf.

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[1]Foreign mineral specialist, Division of International Minerals.
[2]Scinteia. July 4, 1987, pp. 1-2; and July 25, 1987, pp. 1-3.
[3]———. Oct. 6, 1987, pp. 2, 5.
[4]———. Dec. 25, 1987, pp. 1-2.
[5]Vneshnyaya Torgovlya S.S.S.R. (The Foreign Trade of the U.S.S.R.). 1987, p. 167.

The Mineral Industry of Saudi Arabia

By Michael D. Fenton[1]

The Saudi Arabian economy continued to rely heavily on income from exports of oil and oil-based products. However, the country's recession continued for the fifth straight year in 1987 as a result of the combined effects of relatively low oil prices and decreased production, the declining value of the dollar, the Iran-Iraq war, and the global stock market crash. Rising oil prices in 1987 stimulated a slight increase in total gross domestic product (GDP) to about $70 billion, but the GDP was still down 50% from its 1981 level. Government spending had decreased by about 50% while total revenues had fallen by more than 75% since 1981. Persistant budget deficits continued to be covered by dwindling official reserves that may have declined to about $65 billion. Actual government expenditures in 1987, estimated by the U.S. Embassy, Riyadh, were about $44 billion, almost $3 billion less than budgeted. Total 1987 revenues of about $27 billion were $4 billion lower than projected. Petroleum revenues in 1987 were about $17 billion. The $15.5 billion deficit was financed through a draw on official reserves. For the first time in its modern history, the Government announced plans to borrow as much as $8 billion on the bond market to help finance its 1988 budget.

Government oil policy remained constant during the year, which was a pledge to hold oil production below the production quota set by the Organization of Petroleum Exporting Countries (OPEC) and to maintain OPEC's fixed benchmark price of $18 per barrel for Arabian Light crude oil. The purpose appeared to be to generate sufficient oil revenues to meet domestic economic needs while maintaining world oil market stability.

The Government began a major reorganization of the oil industry to increase efficiency and lower costs to cope with declining revenues. The state-owned minerals and refining agency, Petromin, was to be replaced by a company that would report directly to the Supreme Petroleum Council, the top decisionmaking agency. The Arabian-American Oil Co. (Aramco) also would be affected by this reorganization. However, by yearend, no structural changes had been made.

Saudi Arabia had the largest crude oil reserves in the world, more than one-fourth of the world's known oil reserves and about one-third of the known reserves in the market economy countries. The official estimate of the proven recoverable reserves of oil in mid-1986 was 169 billion barrels, and Aramco reported recoverable reserves at the end of 1987 of 167.4 billion barrels. Total recoverable reserves may reach 300 billion barrels through the use of enhanced recovery techniques. These reserves were expected to last over 115 years at current production rates.

Saudi Arabian natural gas reserves were the sixth largest in the world at 146 trillion cubic feet.

PRODUCTION AND TRADE

About 18% of net petroleum imports to the United States came from the Persian Gulf region in 1987; Saudi Arabia, as the world's leading exporter of petroleum, was

the United States third largest supplier. This country had been the leading supplier to the United States of crude oil and petroleum products between 1976 and 1981 when it was replaced by Mexico in 1982-85 and by Canada in 1986-87. Saudi Arabia supplied 11% of total U.S. petroleum imports. U.S. imports from Saudi Arabia in 1987, which consisted almost entirely of crude oils, gasoline, and distillate fuel oil were valued at $4.9 billion. The United States had a trade deficit with Saudi Arabia of $1.8 billion, after many years of a large trade surplus. Sales of petrochemicals to the United States declined significantly, while no exports were made of iron or steel products.

The year began with Aramco producing only an average of 3.7 million barrels per day (bbl/d) between January 1 and January 27, compared with the previous month's average of 5 million bbl/d. The OPEC production quota for Saudi Arabia at that time was 4,133,000 bbl/d, and the Government had stated that it would increase production only if demand rose and the increase was approved by OPEC. It would also adhere to a policy of making sales based on undiscounted, fixed, official Government prices. Shortly thereafter, 1-year contracts at official prices were agreed to by the four former Aramco partners (Exxon Corp., Mobil Corp., Chevron Corp., and Texaco), who would lift 1.3 million bbl/d between February and June 1987 and make adjustments thereafter. Aramco had earlier resisted fixed-price, long-term contracts because the agreed-upon price of $17.52 per barrel for Arabian Light might be more than prevailing market rates. The new contracts, however, allowed companies to underlift without penalty. As might have been expected, the Aramco partners exercised their right to underlift by taking only 700,000 bbl/d in February. Aramco's production declined to about 3.8 million bbl/d in February and 3.2 million bbl/d in March, but perhaps as much as 300,000 bbl/d was being put into floating storage for a lack of buyers. The low point was 2.4 million bbl/d during the first week of March, which was the lowest production since August 1985 when production was about 2 million bbl/d. This was a clear demonstration of the Government's support of OPEC policy.

Oil production in the first quarter of 1987 averaged 3.6 million bbl/d, compared with the fourth-quarter 1986 average of 4.9 million bbl/d. With the increase in the OPEC quota to 4,343,000 bbl/d in June, demand for Saudi oil exceeded supply in June, and nominations for July and August were very high. Production rose to about 4.5 million bbl/d in July and 4.7 million bbl/d in August, but it fell to 4.2 million bbl/d in early November as on-land storage facilities in Bonaire, Netherlands Antilles, and Rotterdam, Netherlands, were replenished and floating oil stocks were eliminated. Liftings by Aramco partners reached a high of 1.4 million bbl/d, but actual liftings in November were less than their nominations. Although the partners were buying discounted oil from Iran, Kuwait, Oman, Qatar, and the United Emirates, Saudi Arabia continued to refuse to offer discounts.

Jeddah Oil Refinery Co. reported 1987 production of 62.5 million barrels of petroleum products and a net profit of $8.8 million, slightly less than its 1986 profit of $8.9 million. Sales increased by 7.2% to $586.7 million. The Ras Tanura refinery processed 380,820 bbl/d of oil, compared with 390,251 bbl/d in 1986. Petromin Lubricating Oil Co. (Petrolube) reported a $5.4 million net profit during the 6 months ending June 30, slightly higher than profits during the first half of 1986. Sales increased by 10.4% to $46.7 million.

The Saudi Basic Industries Corp. (SABIC) reported 1987 revenues of $2.12 billion, more than double the 1986 figure of $990 million. Profits for 1987 were $267 million, compared with $64.8 million in 1986. SABIC sold 8.2 million tons of chemicals, fertilizers, metal products, petrochemicals, and plastic resins. Sales in 1986 and 1985 were 7.3 million tons and 4.96 million tons, respectively. SABIC's affiliated manufacturing plants produced 9.8 million tons of products in 1987, compared with 7.6 million tons in 1986. The rise in sales revenues was attributed to increased prices and greater efficiency.

SABIC increased the combined production capacities of 8 of its 14 plants by 1,069,000 tons per year (tpy) to 9,216,000 tpy. Production had surpassed nominal capacity of these industrial mineral plants substantially during the previous 2 years, and the increase was an indication of SABIC's success in selling its products locally and overseas, particularly in the Far East. Ethylene output increased the most, by 314,000 tpy, to a total annual production capacity of nearly 2 million tpy. Polyethylene output was the second largest increase, to 902,000 tpy, an increase of 202,000 tpy. The plants, their products, effective capacities, and capacity increases are shown in table 1.

Table 1.—Saudi Arabia: Petrochemical plants of Saudi Basic Industries Corp.

Plants	Product	Effective capacity (tons per year)	Capacity increase in 1987 (percent)
Saudi Methanol Co. (Ar Razi)	Methanol	640,000	7
National Methanol Co. (Ibn Sina)	do	770,000	10
Saudi Petrochemical Co. (Sadaf)	Ethylene	760,000	16
Do	Ethylene dichloride	560,000	23
Do	Styrene	360,000	22
Do	Crude industrial ethanol.	300,000	7
Do	Caustic soda	450,000	19
Al-Jubail Petrochemical Co. (Kemya)	Polyethylene	332,000	23
Saudi Yanbu Petrochemical Co. (Yanpet)	Ethylene	560,000	12
Do	Ethylene glycol	250,000	25
Do	Polyethylene	430,000	43
Eastern Petrochemical Co. (Sharq)	do	140,000	8
Do	Ethylene glycol	556,000	17
Arabian Petrochemical Co. (Petrokemya)	Ethylene	650,000	30
Al-Jubail Fertilizer Co. (Samad)	Urea	600,000	20

Saudi Arabia produced a record high 635,500 tons of nitrogen (N) in ammonia, significantly more than the 466,700 tons produced in 1986. Although 1987 ammonia exports were unreported, they were expected to exceed the previous year's figure of 182,700 tons N. Urea production by Saudi Arabian Fertilizer Co. (SAFCO) in Damman and Al-Jubail Fertilizer Co. (Samad) in Jubail also increased from 440,100 tons N in 1986 to 449,100 tons N in 1987. SAFCO recorded net earnings of $34.1 million for 1987, up 2.4%, as urea production increased to 343,000 tons from 330,000 tons in 1986. However, total exports declined during this period from 373,800 tons N to 246,100 tons N. Reasons for this decline were the gulf war, which inhibited shipments to Asia and the Middle East, the absence of India from the marketplace, and increased competition from U.S. producers. Buyers from Western Europe and the United States increased in importance, however.

Table 2.—Saudi Arabia: Production of mineral commodities[1]

Commodity	1983	1984	1985	1986[p]	1987[e]
Cement, hydraulic thousand metric tons	8,126	7,150	8,300	9,190	9,200
Gas, natural:[2]					
Gross million cubic feet	950,000	1,025,900	1,133,000	[e]1,341,000	1,120,000
Marketed[e] do	154,700	252,500	716,000	[3]847,600	708,000
Gypsum thousand metric tons	[r]311	[r]369	410	373	373
Iron and steel: Metal: Steel, crude do	400	842	1,106	[e]1,100	1,100
Lime[e] do	[3]9	[3]12	12	12	12
Natural gas liquids, all forms[2] thousand 42-gallon barrels	118,625	124,100	123,370	149,650	[3]118,625
Nitrogen: N content of ammonia thousand metric tons	293	415	436	467	[3]637
Petroleum:[2]					
Crude thousand 42-gallon barrels	1,657,100	1,701,995	1,236,620	1,841,425	[3]1,535,555
Refinery products:[e]					
Gasoline do	36,700	37,000	[3]49,000	49,000	67,000
Jet fuel do	17,000	17,000	[3]4,100	4,100	5,600
Kerosene do	12,100	12,000	[3]10,300	10,300	14,000
Distillate fuel oil do	68,700	68,700	[3]86,900	86,900	119,000
Residual fuel oil do	92,600	92,600	[3]87,200	87,200	119,300
Unspecified do	77,800	83,200	[3]111,300	111,300	152,300
Refinery fuel and losses do	9,000	10,000	14,000	14,000	19,200
Total do	313,900	320,500	362,800	362,800	496,400
Sulfur: Byproduct, all sources thousand metric tons	[r]793	833	1,068	1,446	1,200

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through Sept. 9, 1988.
[2]Includes Saudi one-half share of production in the Kuwait-Saudi Arabia Divided Zone.
[3]Reported figure.

COMMODITY REVIEW

METALS

Gold.—Boliden AB, the Swedish mining, metals, and chemicals group, signed a temporary management contract with Petromin to develop the Mahd adh Dhahab gold mine, 170 miles northeast of Jeddah. At yearend, Petromin invited international companies to prequalify for a technical assistance and management contract that would run for 12 to 36 months. Petromin had canceled the supervision and construction contracts held by Gold Fields Mahd adh Dhahab in February, 1 year early, and Gold Fields was claiming more than $3 million in compensation. Gold production was expected to begin in April 1988. Annual sulfide ore production of about 120,000 tons was expected to contain 26 grams of gold and 92 grams of silver per ton. Annual production of about 8,500 tons of copper, gold, silver, and zinc concentrates were to be exported for further treatment, perhaps to Boliden's precious metals smelter in Roennskaer, Sweden.

A license for the Al-Amar gold mine, 200 kilometers southwest of Riyadh, was expected to be awarded by early 1988. The Australian-owned BHP-Utah International Inc., based in San Francisco, was the leading contender for the license. Drilling outlined a north vein deposit, 500 meters long, 8 meters wide, and at least 300 meters deep. It contained an estimated 1 million tons of ore graded 0.64 to 0.96 troy ounce of gold per ton.

Approval by the Council of Ministers was pending to begin mining at the Al Masane project, 150 kilometers southeast of Abha near the North Yemen border. The concession covered 50 square kilometers and had proven reserves of 9 million tons. Ore grades were 6% zinc, 2% copper, and 1.9 ounce of silver and 0.05 ounce of gold per ton. The first mine would have a capacity of 1,500 tons per day. This joint venture was between National Mining Co., owned by the royal family, and Arabian Shield Development Co., majority-owned by Saudi citizens, most of them were members of the royal family.

Iron and Steel.—Saudi Iron & Steel Co. (Hadeed) awarded a contract to Eisenbau Essen (EBE) of the Federal Republic of Germany to investigate the possibility of expanding capacity and introducing new product groups. Hadeed was considering diversifying into higher value products such as sections, seamless pipes, and flat-rolled products because of the shrinking market in Bahrain, Kuwait, Oman, Qatar, and the United Arab Emirates for rebars and wire rod. One shipment of 20,000 tons of wire rod was sent to Japan.

An agreement was reached by five of the gulf's most important financial and industrial institutions to build a seamless steel pipe factory at Jubail to supply the oil industry. The project was to include a $220 million seamless tube plant and a $50 million steel-handling unit. The partners were the Arab Industrial Investment Co. of Iraq, Gulf Investment Corp. of Kuwait, and three Saudi Arabian groups: National Industrialization Co. (NIC), SABIC, and The Arab Investment Co.

Titanium.—A license and a major loan from the Saudi Industrial Development Fund were approved by the Government for a planned $90 million, 45,000-tpy titanium dioxide plant in Yanbu. The client was the Crystal Pigment Co., the country's largest private sector chemicals company, whose shareholders were NIC; the Gulf Investment Corp. of Kuwait; the local Shairco for Trading, Industry, and Contracting; and Kerr-McGee Chemical Corp. of the United States. Rutile would be imported, but local deposits of titanium, mainly from the Yanbu area, may be developed.

INDUSTRIAL MINERALS

Cement.—Saudi Arabian cement markets continued to decline as domestic demand fell from a record high 23.8 million tons in 1983, to 13.3 million tons in 1986, and an estimated 12.5 million tons in 1987. Overcapacity in the domestic cement industry and the availability of low-cost imports caused cement prices to fall from about $70 per ton to less than $27 per ton, and local producers were forced to operate at well below their combined capacity of 14.9 million tpy, which included 400,000 tons of white cement and 14.5 million tons of portland cement. Imports were more than 4 million tons in 1986 and were expected to be at the same level in 1987. Prevailing conditions caused a heated debate between Saudi Arabia's 4 major cement importers and its 10 domestic producers over proposed 20% tariffs on foreign cement. The Government announced an investigation of alleged cement dumping on the Saudi Arabian market by suppliers in

Cyprus, Greece, Japan, the Republic of Korea, and Spain.

Fertilizer Materials.—National Chemical Fertilizer Co. (NCFO), a joint venture formed by state-owned SABIC and SABIC affiliate Safco, began operating its new 500,000-tpy anhydrous ammonia plant at Jubail 6 months ahead of schedule. The plant was to produce entirely for export by using the M. W. Kellogg Co. process. SABIC planned to install compound and phosphate fertilizer units by the end of 1989, increasing the total design capacity to 800,000 tpy.

National Chemical Fertilizer Co. (Ibn al-Baytar) began operating on August 30 its 500,000-tpy anhydrous ammonia plant at Jubail, and it produced 151,800 tons of ammonia during the remainder of the year. Meanwhile, it shortlisted five companies for a contract to build a six-unit phosphatic fertilizer complex. The $100 million project would comprise a 500,000-tpy nitrogen phosphate plant, a 200,000-tpy granulated triple super phosphate plant, a 100,000-tpy diammonium phosphate plant, a 10,000-tpy liquid fertilizer plant, and an optional 500,000-tpy granulated urea plant.

MINERAL FUELS

Petroleum.—*Production.*—The Government apparently decided to build, at a cost of $4 billion, underground storage facilities for refined products and crude oil under military bases at Dhahran, Hafr al-Batin, Riyadh, Tabuk, Taif, and Yanbu. The purpose was to develop strategic stores for use in the event of a blockade of the country. The first facility was expected to be at Yanbu and to be built by ABV Rock Group of Sweden, which was involved in planning and geological work for the project.

Aramco temporarily shut down the 150,000 bbl/d offshore Abu Safah oilfield, straddling the offshore demarcation line between Saudi Arabia and Bahrain with ownership divided 50-50 between them. Saudi Arabia agreed to give Bahrain 75,000 bbl/d to replace that which was not produced and offset potential financial hardship to Bahrain.

Refining.—Saudi Arabia appeared to be serious about implementing its new strategy of acquiring downstream refining and distribution operations abroad to secure guaranteed outlets for the country's hydrocarbons. Attock Oil Co. bought the 120,000-bbl/d Texas City refinery, and Arabian Shield Development Co. purchased an 18,500-bbl/d refinery in Silsbee, Texas. Other Saudi investors were negotiating with Crown Central Petroleum Inc.

Two planned projects were canceled or postponed indefinitely: the $40 million Petrolube-3 plant in Yanbu and the 6,000-bbl/d lube oil blending plant in Jeddah that was to have been built by Ahmad Jamjoon and Cofran Lubricants of France. Also, five of the six international companies that originally put in offers for Petromin Lubricating Oil Refining Co.'s (Luberef) second refinery, a 1.5-million-barrel-per-year plant to be built in Yanbu and worth an estimated $160 million, were invited to rebid.

Petrochemicals.—The Eastern Petrochemical Co. (Sharq), a joint venture between SABIC and a Japanese consortium led by Mitsubishi Corp. planned to increase its production by 10% by eliminating production bottlenecks in its plant in 1987. The designed annual capacity was 130,000 tons of linear low-density polyethylene and 300,000 tons of ethylene glycol.

Hydrocarbon Solvent Co. invited bids for the construction of a 70,000-tpy aromatics and aliphatics solvents plant at Yanbu. Feedstock kerosene and naphtha for the new plant, to be completed before 1989, would come from nearby refineries.

SABIC was considering a plan to double the capacity of the 640,000-tpy Saudi Methanol Co. (Ar Razi) plant in Jubail. The plant was 50%-owned by Mitsubishi Gas Chemical Co., which took one-half of the production. Remaining production went to Singapore and Western Europe.

Arabian Petrochemical Co. (Petrokemya) started production at its new 50,000-ton-per-year butene-1 unit in its Jubail petrochemical complex. Feedstock came from the nearby 500,000-tpy ethylene plant, and production moved by pipeline to SABIC's two polyethylene plants at Jubail for the production of linear low density and high density polyethylene resins. The volume of ethylene exports by Petrokemya was reduced as ethylene was used to produce butene-1.

The National Industrialization Co. gained a 10% share of the National Plastic Co. (Ibn Hayyan) in Jubail worth $11.7 million, according to the privatization plan of SABIC, which originally had an 85% share of Ibn Hayyan. The private companies, Saudi Plastic Products Co. and the Arabian Plastics Manufacturing Co., also acquired 1% and 0.6% shares, respectively. The new ownership reduced SABIC's holding to 73.4% as of September 1987. Ibn Hayyan began annual production of 300,000 tons of vinyl chloride monomer (VCM) and 200,000 tons of polyvi-

nyl chloride (PVC) in 1986. Most of the VCM was sold in the Far East, and the PVC was sold locally.

Transportation.—Aramco completed its looping project on Petroline, which extends 1,215 kilometers from the Abqaiq-Ghawar oilfields in the Eastern Province to Yanbu on the Red Sea coast. Capacity was increased to nearly 3.2 million bbl/d from the previous 1.85 million bbl/d, and full capacity of 500,000 bbl/d was consequently achieved through the Iraqi-owned Iraq Pipeline Trans Saudi Arabia 1 (IPSA-1), which carried Basrah Light oil about 630 kilometers from Iraq's southern oilfields to Petroline pump station PS-3. Aramco was considering a project that would increase capacity of Petroline to 4.8 million bbl/d by installing higher capacity pumps at a cost of $400 million. The capacity of the natural gas liquids line would also be increased from 290,000 bbl/d to 430,000 bbl/d.

Iraq awarded a contact of nearly $1.5 billion for the construction of a pipeline system, phase 2 (IPSA-2), which would link IPSA-1 at PS-3 to the new export terminal about 12 miles south of Yanbu and service tankers as large as 400,000 deadweight tons. IPSA-2, 970 kilometers of 48-inch and 56-inch pipeline, would parallel Petroline and would have a capacity of 1.6 million bbl/d, which would raise Iraq's export capacity to 3.3 million bbl/d. Recipients of the contract were Saipem S.p.A. of Italy, Mitsubishi, Hyundai of the Republic of Korea, and Spie-Capag of France.

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[1]Physical scientist, Division of International Minerals.

The Mineral Industry of Sierra Leone

By David J. Ellis[1]

Production and exports of mineral commodities continued to be the backbone of the economy of Sierra Leone, despite heavy losses of potential Government revenue to smuggling. Exports of minerals accounted for approximately 60% of Government revenue.

Production and exports of rutile and bauxite ores and concentrates increased substantially in response to production capacity increases and continuing world demand. In contrast, production and exports of gold and diamonds remained stagnant or decreased.

Sierra Leone continued to experience problems with its monetary system in the wake of the introduction of a freely floating exchange rate for the leone in 1986. The leone was devalued so much that the Government experienced a liquidity crisis in early 1987 when a banknote shortage was caused by the withdrawal and hoarding of currency. Emergency measures had to be passed to bring some of the leones back into circulation, and the Government was forced to mint new banknotes to meet the demand. Some civil servants were not paid for 2 or 3 months and there were resulting "go-slow" strikes in the capital city, Freetown.

Official exports of gold increased slightly compared with those of the previous year. No realistic production figure was available, however, owing to the high percentage of unrecorded, and often unlicensed, production. Diamond statistics were similarly problematic, with official production from the Government-owned National Diamond Mining Co. (NDMC) reported to be down 43% compared with 1986. Exports of diamonds were approximately 300,000 carats, slightly less than in the previous year. Estimates of lost revenue from illicit diamond exports ranged as high as $100 million.[2]

Sierra Leone produced no oil, so feed for the Sierra Leone Petroleum Refining Co.'s Freetown refinery was imported from Guinea, Iran, and Nigeria. There were petroleum shortages throughout the year, as a result of a lack of foreign earnings to purchase crude oil.

PRODUCTION AND TRADE

Sierra Leone's principal export market was the European Economic Community (EEC), which purchased nearly 70% of total exports. Among EEC countries, the Netherlands, the United Kingdom, and the Federal Republic of Germany were the biggest importers of Sierra Leone's goods, in decreasing order of value. The United States received about 20% of Sierra Leone's exports, mainly rutile and bauxite ores.

Suppliers of goods to Sierra Leone were more diversified, although the EEC also provided about 40% of imports. Among EEC countries the United Kingdom, the Federal Republic of Germany, and the Netherlands were the largest suppliers, in order of decreasing importance. Sierra Leone's imports of U.S. goods increased during 1986-87 and were estimated to be slightly below 20% of total imports in both years. Sierra Leone also received approximately 10% of its imports from China, and about 6% from Japan. Fellow members of the Economic Community of West African States provided about 20% of Sierra Leone's imports.

Production and exports of rutile ore and

concentrate from Sierra Rutile Ltd. (SRL) increased for the third consecutive year. Production was up 17%, and shipments rose 22% compared with 1986 levels. SRL's principal markets were Western Europe and the United States. The average price paid for the rutile concentrate was $411 per ton in 1987. SRL also exported 3,300 tons of ilmenite ore.

Production and exports of bauxite also increased in comparison with 1986 levels. Production rose nearly 12% more than that of 1986, while exports increased approximately 15% over 1986 levels to 1.28 million tons. Of that 900,000 tons was shipped on a wet basis, and 380,000 tons was shipped dry.

Table 1.—Sierra Leone: Production of mineral commodities[1]

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
Aluminum: Bauxite, gross weight thousand metric tons	785	1,040	1,184	1,242	[3]1,390
Diamond:[4]					
Gem[e] thousand carats	242	240	243	215	200
Industrial[e] do.	103	105	106	100	100
Total do.	345	345	349	315	300
Gold[4] troy ounces	12,000	18,223	19,004	12,000	[3]12,000
Gypsum	4,000	4,000	[e]4,000	[e]4,000	4,000
Iron ore metric tons	420,000	355,000	[e]70,000	[e]4,000	4,000
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	213	238	287	[e]300	250
Jet fuel do.	112	128	162	[e]170	150
Kerosene do.	93	93	55	[e]50	50
Distillate fuel oil do.	671	709	443	[e]450	450
Residual fuel oil do.	400	433	379	[e]360	360
Liquefied petroleum gas do.	9	9	9	[e]9	9
Other do.	1	1	1	[e]1	1
Refinery fuel and losses do.	60	64	60	[e]60	60
Total do.	1,559	1,675	1,396	[e]1,400	1,330
Salt[e] thousand metric tons	200	200	200	200	200
Titanium:					
Rutile ore and concentrate 96% TiO_2, gross weight metric tons	71,800	91,300	80,611	97,100	[3]113,300
Ilmenite ore and concentrate 60% TiO_2, gross weight do.	--	--	--	--	[3]5,600

[e]Estimated. [p]Preliminary.

[1]Table includes data available through Aug. 1, 1988

[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. Sierra Leone annually refined 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 is originally collected. This output would be in addition to that reported in this table.

[3]Reported figure.

[4]Data are based on official exports and do not reflect smuggled material.

COMMODITY REVIEW

METALS

Nord Resources Corp. of Dayton, Ohio, successfully renegotiated its contract to retain full ownership of SRL's titanium mining concession at Gbamgbama, near Bonthe, and commenced production of ilmenite as a byproduct of rutile. The ilmenite was relatively high-grade, more than 60% titanium dioxide (TiO_2), but well below the purity of the SRL rutile, which contained about 96% TiO_2.

The tailings recovery plant, which was installed in 1986 to increase production capacity, was reported to be operating at its 8,000-ton-per-year capacity. However, the supplemental bucketwheel dredge, also installed in 1986, was not performing as expected and was slated for redesign. A new dry-mill-feed preparation plant was commissioned, and modifications were made to the existing dry-mill circuit to improve recovery.

INDUSTRIAL MINERALS

The Precious Minerals Marketing Co. continued to oversee the operations of the NDMC, although the managing director of NDMC was relieved of the position in March. Dwindling diamond production at NDMC operations at Yengema was blamed on deteriorating equipment, lack of spare parts, and uncontrolled smuggling. Near yearend it was announced that Sumatu Raygreen Mining Co. (Sierra Leone) was to loan NDMC $4 million for the purchase of new equipment in return for the rights to purchase 40% of NDMC production. Diamonds from both NDMC and from private operators continued to be sold by tender at the Bank of Sierra Leone in Freetown.

Oliver Resources PLC of Ireland was granted licenses to mine gold and diamonds on 78 square kilometers in the Northern Province. The concession includes alluvial sand and gravel deposits along tributaries of the Pampana River, which drain the Sula Mountains and the Kangari Hills, identified as possible source areas for placer gold and alluvial diamonds. Oliver was examining other prospective areas in Sierra Leone, with the expectation of being awarded further concessions with potential for open pit gold and diamond mining.

The Government continued its efforts to promote development of the kimberlite deposits at Koidu, but no firm commitments for funding or joint-venture participation had been received by yearend, despite negotiations with several local and international companies, including Diamond Corp. of West Africa (a subsidiary of De Beers Consolidated Mines Ltd.) Outokumpu Oy of Finland, Afro-West Mining Ltd. of Australia, and Bin Rafaah Mining Co. of Saudi Arabia.[3]

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from leones (Le) to U.S. dollars at the rate of Le30.77 = US$1.00. However, the exchange rate of the leone fluctuated in response to auction prices for foreign exchange, and the leone devalued fairly steadily throughout 1987.

The Economist (London). V. 305, No. 7527, Dec. 5, 1987, p. 50.

[3]Africa Economic Digest (London). V. 8, No. 38, Sept. 25, 1987, pp. 10, 18.

The Mineral Industry of the Republic of South Africa

By George A. Morgan[1]

In 1987, mining and quarrying in the Republic of South Africa by about 1,000 mines and quarries accounted for $10.1 billion,[2] or about 14% of a gross domestic product of $74.2 billion, compared with 7% for agriculture, 20% for manufacturing, 11% for general government, and 8% for transportation. Crude and processed mineral exports combined accounted for about 66% of the country's total foreign earnings.

The total value of mineral sales for the Republic of South Africa was $15.2 billion in 1987, of which gold made up $8.6 billion, or 57% and coal $2.4 billion or 16%.

Total sales in the manufacturing sector were $49.2 billion, of which $3.9 billion was iron and steel; $3 billion was industrial chemicals; $1.3 billion was industrial mineral products; and $1.2 billion was nonferrous metal products.

Mining activity was primarily by six major mining houses: Anglovaal Ltd., Anglo American Corp. of South Africa Ltd. (AAC), Barlow Rand Ltd. (BRL), General Mining Union Corp. Ltd. (Gencor), Gold Fields of South Africa Ltd. (GFSA), and Johannesburg Consolidated Investment Co. Ltd. (JCI).

The South African Reserve Bank reported total gold assets of $2.5 billion as of January 31, 1988, and that its total physical holdings of gold were 6.2 million troy ounces at the end of July 1987.

Total income tax collected from gold mines for the financial year ending March 31, 1988, was $1.2 billion; for diamond the tax was $460 million. The export duty on diamond was $12 million. Rents and royalties on gold mining leases were $319 million; on diamond leases $34 million; and on other mining leases $49 million. For selected excise taxes on goods, the fuel tax garnered $528 million.

The average number of people employed on all mines and quarries during 1987 was 780,016, compared with 781,621 in 1986, and consisted of 558,337 in gold mines, 114,713 in coal mines, and 106,966 in all other mines. Total earnings by this mine labor force were $3.6 billion. Of 1,336,500 people employed in manufacturing, 124,500 were in production of metal products; 109,500 were in base metals; 80,000 were in industrial mineral products; and 91,600 were in chemical and chemical products.

In an attempt to gain greater worker participation in corporate ownership and to lessen the impact of union influence in the mining industry, AAC and Severin Mining and Development Co. Ltd. (Sevmin) announced the creation of share holding plans at little or no cost to their employees. AAC was to issue five shares in 1988 to each employee in the headquarters office who had served for 2 years. Depending upon the company's earning performance, a similar offer was to be made every year for the next 4 years. Share value to each employee was estimated at $750. AAC requested about 70 corporation affiliates to provide shares to about 250,000 qualifying employees. Sevmin was setting up a trust fund for the Eersteling Mine near Pietersburg from shares supplied by Sevmin's cofounder. Each black worker earning less than $369 per month would qualify for 100 shares paid for by the trust.

As part of the overall effort to reduce costs the mine operators sought to implement advances in processing and technology where possible, particularly to reduce labor cost, which accounted for more than 50% of total cost at some mines. Use of rubber-tired vehicles was implemented at

JCI's Randfontein and Western Areas Mines. Improved shaft sinking methods were employed to reduce shaft sinking time, which can take several years for deep, large-diameter, multicompartment shafts. The use of jumbo drills in shaft sinking can reduce labor requirements at the shaft bottom from 78 to about 15 workers. Regulations for the carrying of self-contained self-rescuers by underground workers were passed in 1986, and at yearend 1987, about 30% of underground coal miners were so equipped. The self-rescuers were expected to be introduced into gold mines in 1988.

Government Policies and Programs.—The Mines and Works Act of 1956 was amended in September to repeal the definition of "scheduled person," which originally allowed 13 job classifications requiring certificates of competency to be held only by whites and certain other groups. These classifications account for about 3% of total positions on mines and plants, and about one-third of the estimated white labor force of 70,000. These certificates, including the blasting certificate that is required for advancement to many higher positions, are now available to all qualified individuals. By yearend 1987, over 5,000 people were employed in jobs previously reserved for whites.

Bophuthatswana, with resources of asbestos, chromite, and platinum-group metals, was dissatisfied with mining contracts completed before 1977, and indicated legal action might be taken against those companies failing to explore or develop mineral rights in the region. Special tax concessions were being offered to companies that set up operations in Bophuthatswana.

Taxation policy allowed operators of new gold mines to deduct 100% of capital expenditure from mining income in the year the expenditure was incurred, and to carry forward unused balances of these expenditures. A capital allowance of 5% to 10% was allowed on normal taxation and mining lease payments.

PRODUCTION AND TRADE

The index of physical volume of all mining production, including gold, was 92.5 in 1987 compared with 100.8 in 1986 (1980=100). The index of physical volume for 1987 and 1986, respectively, of iron and steel basic industries was 101.6 compared with 104.7; of nonferrous metal basic industries, 118.3 compared with 111.6; and of industrial chemicals, 89.7 compared with 93.0.

A major strike by the National Union of Mineworkers (NUM) between August 9 and August 30 affected 33 of the Chamber of Mines 99 gold and coal mines; about 225,000 miners struck over primarily higher wage demands. Gold output for the third quarter was down about 8% at some of the struck mines, compared with the previous quarter. Cost to the miners in terms of lost wages was estimated at $5 million per day, and about 225,000 ounces of gold in ore was not mined. The National Union of Metal Workers (Numsa) was formed in May 1987 with the amalgamation of 8 trade unions, and had 80,000 members out of a total of about 340,000 in the metals sector. Numsa struck several metal plants in July, including ferroalloy and steel plants, over issues of pay and holidays, with mixed results. The union competed with 14 other unions for industry representation.

Heavy rains and flooding washed out roads and railways to the ports of Durban and Richards Bay for about a week beginning September 26. The power supply to the main coal loading terminal at Richards Bay was also cut. Loadings of coal were from stockpiled material prior to resumption of rail shipments to the port. The road link between Durban and Richards Bay, which was used for moving ships stores to Richards Bay, was also cut.

Total transport earnings were $1.2 billion in 1987, of which 9.4% was from coal, ores,

and minerals. A total of 58,903 people were employed in the sector, and earned $250 million.

Exports of coal and minerals through the port of Maputo in Mozambique were to be about 5.5 million tons by yearend 1988, partly owing to South African assistance in rehabilitating the port. The rail link from Komatipoort has been doubled to eliminate bottlenecks for shipments from the eastern Transvaal.

Exports of scrap iron and steel were controlled by the Board of Trade and Industries, which operates a licensing system whereby local scrap consumers receive preferential access to scrap at a 7.5% discount to the export price of scrap. Most consumption was by Iscor and its subsidiaries, and several iron and steel foundries. Apparent exports are listed in table 2. Owing to incomplete import statistics for 1986, the latest available import data are published in the previous edition of this chapter.

Table 1.—Republic of South Africa: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
METALS					
Aluminum metal	161,300	167,357	164,600	171,575	[e]170,000
Antimony concentrate:					
Gross weight	10,670	12,924	12,600	11,553	[e]11,500
Sb content	6,302	7,440	7,390	6,816	[e]6,800
Beryl concentrate (11% to 12% BeO)_ kilograms	20,500	1,000	4,649	3,133	135
Chromite, gross weight:					
More than 48% Cr_2O_3 thousand tons	25	53	65	39	65
44% to 48% Cr_2O_3 do	1,070	1,242	1,975	2,294	2,236
Less than 44% Cr_2O_3 do	1,137	1,711	1,658	1,574	1,483
Total[2 3] do	2,232	3,006	3,699	3,907	3,784
Cobalt:[e]					
Mine output, Co content	690	690	690	690	720
Metal, elemental	500	500	500	500	520
Columbium-tantalum concentrate kilograms	406	317	1	--	454
Copper:					
Mine output, Cu content	204,984	198,179	195,436	184,205	213,027
Metal:					
Smelter	192,300	178,700	191,700	[r e]192,000	[e]192,000
Refined	157,700	155,722	164,304	158,631	152,699
Gold, primary thousand troy ounces	21,847	21,861	21,524	20,513	19,228
Iron and steel:					
Ore and concentrate:					
Gross weight thousand tons	16,605	24,647	24,414	24,483	21,996
Fe content do	10,627	15,749	15,076	15,424	13,545
Metal:					
Pig iron do	5,213	5,455	6,574	[e]6,800	[e]6,700
Ferroalloys, blast furnace and electric-furnace:					
Ferrochromium do	675	[r]867	851	870	951
Ferromanganese do	167	[r]237	331	337	315
Ferrosilicochromium do	18	27	5	[e]5	[e]27
Ferrosilicomanganese do	131	[r]181	261	303	314
Ferrosilicon do	50	[r]89	75	83	83
Ferrovanadium do	[e]1	[r(4)]	([4])	1	[e]1
Silicon metal do	[r]27	[r]34	36	35	34
Total[2] do	[r]1,068	[r]1,336	1,560	1,635	1,725
Steel, crude do	7,190	7,827	8,582	[e]8,800	[e]8,700
Semimanufactures:					
Hot-rolled products do	NA	NA	7,005	7,189	NA
Iron castings do	286	322	NA	NA	NA
Steel castings and forgings do	112	111	101	91	NA
Lead:					
Mine output, Pb content	87,533	94,764	98,424	97,778	93,642
Smelter, secondary	23,600	30,794	32,836	40,463	[e]41,000
Manganese:					
Ore and concentrate, gross weight:					
Metallurgical:					
More than 48% Mn thousand tons	674	753	950	954	889
45% to 48% Mn do	268	448	213	338	438
40% to 45% Mn do	415	432	837	991	773
30% to 40% Mn do	1,270	1,225	1,442	1,280	666
Total[2] do	2,627	2,858	3,443	3,564	2,767

See footnotes at end of table.

Table 1.—Republic of South Africa: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
METALS —Continued					
Manganese —Continued					
Chemical:					
More than 65% MnO_2 thousand tons	(4)	(4)	1	4	3
35% to 65% MnO_2 do	98	123	118	135	117
Less than 35% MnO_2 do	161	69	38	16	5
Total[2] do	259	192	158	156	125
Total manganese[2] do	2,886	3,049	3,601	3,719	2,892
Metal	23,367	36,776	31,825	e32,000	28,000
Nickel:[e]					
Mine output, Ni content	20,500	25,000	25,000	r31,800	34,300
Metal, electrolytic	17,000	520,500	20,000	r25,400	27,400
Platinum-group metals, metal content of concentrate, matte, refinery products[e 6] thousand troy ounces	2,600	3,500	3,700	3,960	4,220
Silver:					
Mine output, Ag content do	6,513	6,997	6,700	7,145	6,691
Primary do	1,950	2,000	2,000	2,000	1,900
Tin:					
Concentrate:					
Gross weight[e]	6,700	5,900	5,600	5,250	3,620
Sn content	2,668	2,301	2,153	2,054	1,412
Metal, primary	r2,685	r1,592	r2,069	r2,001	1,400
Titanium:[e]					
Rutile concentrate	56,000	56,000	55,000	55,000	55,000
Slag	417,300	417,300	435,000	435,000	650,000
Uranium oxide (U_3O_8)	7,128	6,762	5,744	5,460	4,735
Vanadium:					
Vanadiferous slag, gross weight	35,825	45,911	57,340	e68,170	e69,000
V content:					
Of vanadiferous slag[e]	5,100	6,500	8,085	9,600	9,700
Of V_2O_3 and vanadate products[e]	3,733	6,017	5,930	5,761	3,792
Total	8,833	12,517	14,015	15,361	13,492
Zinc:					
Concentrate:					
Gross weight[e]	200,000	200,000	190,000	200,000	220,000
Zn content	109,981	106,107	96,943	101,859	112,686
Metal, smelter	84,384	88,406	93,700	81,000	90,051
Zirconium concentrate (baddeleyite) and zircon	162,281	153,123	160,533	e160,000	e160,000
INDUSTRIAL MINERALS					
Asbestos:					
Amosite	40,656	33,237	37,856	36,009	26,026
Chrysotile	93,016	75,414	91,645	91,001	101,722
Crocidolite	87,439	58,738	34,073	11,852	20,682
Total	221,111	167,389	164,247	138,862	148,430
Barite	6,683	4,467	4,387	8,653	8,617
Cement, hydraulic thousand tons	7,897	8,188	7,034	6,712	7,256
Clays:					
Attapulgite	4,425	4,843	5,885	10,125	6,026
Bentonite	39,529	41,849	43,472	48,265	48,953
Fire clay	117,807	162,665	168,145	202,883	230,519
Flint clay	69,984	93,755	123,810	130,721	106,915
Fuller's earth	312	--	--	--	--
Kaolin	129,605	136,160	128,899	126,129	151,730
Corundum, natural	49	21	10	9	5
Diamond:					
Gem[e] thousand carats	4,554	4,516	4,550	4,473	3,631
Industrial[e] do	5,757	5,627	5,652	5,755	5,420
Total do	10,311	10,143	10,202	10,228	9,051
Diatomite	1,088	258	214	1,800	194
Feldspar	45,114	39,018	33,012	52,762	66,513
Fluorspar:					
Acid-grade	232,750	289,294	310,211	293,368	e279,000
Ceramic-grade	6,406	4,502	5,724	7,703	e7,000
Metallurgical-grade	28,446	25,410	33,272	32,814	e30,606
Total	267,602	319,206	349,207	333,885	316,606
Gem stones, semiprecious:					
Emerald crystals kilograms	575	440	102	23	--
Tiger's-eye do	120,000	111,500	178,821	257,554	400,647

See footnotes at end of table.

Table 1.—Republic of South Africa: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
INDUSTRIAL MINERALS —Continued					
Gypsum, crude	518,353	535,286	458,399	404,205	349,079
Kyanite-related materials:					
Andalusite	116,576	143,305	194,693	181,466	194,373
Sillimanite	815	1,311	1,337	1,330	1,243
Lime[7] thousand tons	1,892	2,110	2,014	1,944	1,582
Magnesite, crude	22,560	33,059	28,898	61,186	74,961
Mica:					
Sheet kilograms	--	--	81	--	--
Waste	2,672	4,478	2,072	2,509	1,325
Nitrogen: N content of ammonia thousand tons	575	580	[e]580	[e]580	[e]500
Phosphate rock, gross weight do	2,887	2,496	2,433	2,920	2,623
Pigments, mineral, natural:					
Ochers	1,319	746	528	1,340	621
Oxides	369	245	224	161	147
Total	1,688	991	752	1,501	768
Pyrites, gross weight[e]	1,500,000	875,000	900,000	940,000	890,000
Quartz, quartzite, glass sand (silica) thousand tons	1,184	1,471	1,518	1,655	1,937
Salt	744,295	615,531	722,482	752,440	703,620
Silcrete	1,839	1,153	47	--	--
Sodium sulfate	630	820	75	466	241
Stone, n.e.s.:					
Dimension:					
Granite:[7]					
Sawn slabs	11,000	13,345	11,708	10,946	17,242
Rough blocks	150,000	196,237	315,707	317,079	323,582
Marble	4,936	1,000	1,000	2,539	2,624
Slate	40,000	45,100	42,100	39,853	25,494
Crushed and broken:					
Limestone thousand tons	19,874	21,084	20,520	20,898	21,372
Shale do	454	533	527	526	354
Sulfur:					
S content of pyrites do	474	464	562	499	468
Byproduct:					
Of metallurgy[e] do	125	[e]91	85	108	105
Of petroleum[e] do	32	30	100	110	110
Total[e] do	631	585	747	717	683
Sulfuric acid, gross weight[8] do	3,201	NA	NA	NA	NA
Talc and related materials:					
Talc	7,617	10,561	10,220	8,641	8,005
Pyrophyllite (wonderstone)	3,575	3,851	4,227	4,606	3,467
Vermiculite	153,034	173,759	184,070	193,657	228,863
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite thousand tons	2,227	3,228	4,910	4,990	5,252
Bituminous do	142,896	159,681	168,606	171,871	171,465
Total do	145,123	162,909	173,516	176,861	176,717
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	38,325	37,400	37,400	[e]37,500	NA
Jet fuel do	3,285	3,200	3,280	[e]3,300	
Kerosene do	3,650	3,488	3,410	[e]3,400	
Distillate fuel oil do	40,880	38,791	39,165	[e]39,200	
Residual fuel oil do	21,900	21,312	21,645	[e]21,600	
Lubricants do	2,555	2,625	2,520	[e]2,500	
Other do	12,410	12,492	12,470	[e]12,500	
Refinery fuel and losses do	6,205	[e]6,000	[e]6,000	[e]6,000	
Total do	129,210	125,308	125,890	[e]126,000	[e]126,000

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

[1]Table includes data available through Sept. 12, 1988.

[2]Data may not add to totals shown because of independent rounding.

[3]Excludes Bophuthatswana, which was as follows, in thousand tons: 1983—234; 1984—401; and 1986—454.

[4]Less than 1/2 unit.

[5]Reported figure.

[6]Includes osmiridium from gold ores, estimated at 2,500 troy ounces per year.

[7]Domestic sales plus exports.

[8]Sulfuric acid was produced from gases derived from local smelting operations and from burning imported elemental sulfur.

Table 2.—Republic of South Africa: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	23	451	--	France 426; West Germany 25.
Oxides and hydroxides	18	3	--	All to United Kingdom.
Ash and residue containing aluminum	264	1,126	--	Spain 790; Belgium-Luxembourg 258.
Metal including alloys:				
Scrap	9,162	7,758	184	Japan 4,237; West Germany 2,034.
Unwrought	r57,811	82,609	32,372	Taiwan 17,532; West Germany 16,028.
Semimanufactures	3,923	6,491	4,404	Japan 997; Taiwan 705.
Antimony:				
Ore and concentrate	r 2,1,452	2964	17	Belgium-Luxembourg 304; France 163.
Oxides	r5,120	5,410	5,342	United Kingdom 60.
Metal including alloys, all forms	--	14	--	West Germany 10; Netherlands 3.
Arsenic: Oxides and acids	113	2,307	1,210	United Kingdom 1,097.
Beryllium:				
Ore and concentrate	36	35	35	
Metal including alloys, all forms	--	1	1	
Cadmium: Metal including alloys, all forms	128	28	--	Netherlands 20; United Kingdom 8.
Chromium:				
Ore and concentrate thousand tons	r 2,1,415	2,1,009	309	Japan 380; West Germany 188; Italy 43.
Oxides and hydroxides	1,218	1,135	1,135	
Metal including alloys, all forms	--	15	--	All to United Kingdom.
Cobalt:				
Oxides and hydroxides	2	1	--	All to West Germany.
Metal including alloys, all forms	88	99	10	United Kingdom 37; Netherlands 20; West Germany 16.
Columbium and tantalum: Metal including alloys, all forms:				
Columbium (niobium)	--	2	--	All to Netherlands.
Tantalum	412	--		
Copper:				
Ore and concentrate	70,165	37,707	--	All to Japan.
Matte and speiss including cement copper	1,100	1,388	--	Greece 1,263; West Germany 125.
Oxides and hydroxides	9	6	--	All to Netherlands.
Ash and residue containing copper	2,034	--		
Metal including alloys:				
Scrap	163,094	11,941	--	West Germany 6,671; Belgium-Luxembourg 1,685.
Unwrought	154,418	141,834	10,576	West Germany 55,820; Belgium-Luxembourg 31,501; Italy 18,596.
Semimanufactures	r5,256	6,484	3,492	Hong Kong 1,740; Canada 547.
Gold:				
Ore and concentrate value, thousands	--	$371	$371	
Waste and sweepings do.	$631,585	$13	$13	
Metal including alloys, unwrought and partly wrought thousand troy ounces	r4,891	3,5,489	218	Italy 3,669; Japan 1,023; West Germany 514.
Iron and steel:				
Iron ore and concentrate:				
Including roasted pyrite	--	18	--	All to Switzerland.
Excluding roasted pyrite thousand tons	r 2,10,226	8,851	--	Japan 5,508; United Kingdom 1,222; West Germany 861.
Pyrite, roasted	37	--		
Metal:				
Scrap	r51,607	143,414	--	Japan 101,450; Taiwan 38,872.
Pig iron, cast iron, related materials	r404,873	630,003	29,887	Japan 541,387; Spain 23,653.

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	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Ferroalloys:				
Ferrochromium, all forms	[2]758,617	[2]877,971	206,129	West Germany 121,488; France 82,483.
Ferromanganese, all forms	[2]458,165	[2]529,413	132,040	Italy 24,783; United Kingdom 17,340.
Ferromolybdenum	4	2	--	All to West Germany.
Ferronickel	60	58	27	West Germany 21; United Kingdom 10.
Ferrosilicochromium	486	1,081	1,063	United Kingdom 18.
Ferrosilicomanganese	86,881	114,303	80,415	West Germany 19,995; United Kingdom 11,003.
Ferrosilicon	r [2]41,016	[2]40,069	5,177	West Germany 4,210; Belgium-Luxembourg 2,486.
Silicon metal	[2]29,067	[2]29,985	1,602	West Germany 3,003; United Kingdom 1,053.
Unspecified	r454,593	367,309	437	Japan 341,201; Canada 20,008.
Steel, primary forms	r554,169	564,727	90,552	Taiwan 114,204; Hong Kong 100,624; Greece 73,089.
Semimanufactures:				
Bars, rods, angles, shapes, sections	r441,338	611,379	101,469	Hong Kong 326,437; United Kingdom 51,117.
Universals, plates, sheets	r395,570	558,747	247,047	Japan 56,985; Hong Kong 55,641; Taiwan 51,938.
Hoop and strip	r2,137	32,499	--	Hong Kong 32,199; Greece 108.
Rails and accessories	r160	890	--	Chile 352; Belgium-Luxembourg 269; France 269.
Wire	r20,319	25,841	10,933	West Germany 3,111; Taiwan 2,588.
Tubes, pipes, fittings	r114,940	84,195	41,548	Netherlands 10,471; West Germany 7,958.
Castings and forgings, rough	r85	1,008	17	West Germany 744; Hong Kong 176.
Unspecified	--	125	125	
Lead:				
Ore and concentrate	[2]103,000	[2]102,637	--	Japan 37,469; France 37,334.
Oxides	r861	190	--	Canada 116; Chile 51.
Ash and residue containing lead	374	985	--	Belgium-Luxembourg 722; West Germany 105.
Metal including alloys:				
Scrap	698	1,311	--	Italy 497; Taiwan 377; West Germany 217.
Unwrought	37,888	17,660	--	Austria 5,550; Italy 4,739; Portugal 3,630.
Semimanufactures	81	1,457	--	West Germany 1,368; Hong Kong 79.
Lithium: Ore and concentrate	3,026	1,509	1,509	
Magnesium: Metal including alloys:				
Scrap	228	296	--	West Germany 129; United Kingdom 109; Italy 58.
Unwrought	64	--		
Semimanufactures	11	11	--	Netherlands 6; United Kingdom 5.
Manganese:				
Ore and concentrate, all grades thousand tons	[2]2,890	[2]2,416	28	Japan 1,018; Norway 332; West Germany 235.
Oxides	r2,610	3,691	2,911	Taiwan 476; Canada 84.
Metal including alloys, all forms	17,635	19,759	8,514	United Kingdom 3,648; West Germany 3,286.
Molybdenum:				
Ore and concentrate	86	--		
Metal including alloys, all forms	--	22	--	Taiwan 19; United Kingdom 2.
Nickel:				
Ore and concentrate	--	20	--	All to France.
Matte and speiss	294	29,165	--	Norway 29,014.
Ash and residue containing nickel	70	4	--	All to Netherlands.
Metal including alloys:				
Scrap	419	261	--	United Kingdom 135; Netherlands 61; Canada 34.
Unwrought	r16,422	17,615	2,482	West Germany 4,515; France 2,283; Italy 2,165.
Semimanufactures	48	782	--	Taiwan 706; France 59.

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	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Platinum-group metals:				
Waste and sweepings value, thousands	$142	--		
Metals including alloys, unwrought and partly wrought:				
Palladium troy ounces	579,613	529,458	529,458	
Platinum do	1,051,007	1,176,201	1,176,201	
Rhodium do	115,485	97,706	97,706	
Iridium, osmium, ruthenium do	95,648	111,274	111,274	
Unspecified value, thousands	$329,426	$461,958	$619	Japan $239,953; West Germany $50,440; United Kingdom $38,385.
Silver:				
Ore and concentrate, Ag content thousand troy ounces	[2]7,012	[2]7,314	--	NA.
Waste and sweepings do	$3,625	$5,781	$1,315	Switzerland $2,097; United Kingdom $1,737.
Metal including alloys, unwrought and partly wrought do	[r]$24,635	$10,709	$793	United Kingdom $7,997; West Germany $1,528.
Tin:				
Ore and concentrate	3,276	1,398	--	United Kingdom 1,239; Netherlands 159.
Oxides	([4])	4	--	All to United Kingdom.
Ash and residue containing tin	305	96	--	Netherlands 53; United Kingdom 20; Belgium-Luxembourg 17.
Metal including alloys:				
Scrap	50	17	--	All to United Kingdom.
Unwrought	717	1,135	35	United Kingdom 664; Japan 175; Italy 126.
Semimanufactures	--	281	--	West Germany 280.
Titanium:				
Ore and concentrate	60,079	56,594	33,678	West Germany 5,222; France 2,844.
Oxides	761	1,760	1,549	West Germany 177.
Ash and residue containing titanium	[r]164,049	152,239	152,239	
Metal including alloys, all forms	--	13	--	All to United Kingdom.
Tungsten:				
Ash and residue containing tungsten	69	--		
Metal including alloys:				
Scrap	17	11	11	
Unspecified	86	18	--	West Germany 12; United Kingdom 6.
Uranium and thorium:				
Ore and concentrate value, thousands	$34,105	$32,139	--	All to Canada.
Oxides and other compounds	1,244	4,204	4,204	
Vanadium: V_2O_5 content of all products	[2]22,018	[2]29,728	492	NA.
Zinc:				
Ore and concentrate	[2]12,840	[2]29,510	--	NA.
Oxides	[r]25	73	--	New Zealand 52; United Kingdom 17.
Metal including alloys:				
Scrap	267	76	--	Taiwan 58; Portugal 18.
Unwrought	5,585	12,712	11,730	Taiwan 545; United Kingdom 203.
Semimanufactures	[r]117	370	67	Portugal 247; Chile 28.
Zirconium: Ore and concentrate	106,819	120,211	22,588	West Germany 26,872; Japan 18,513.
Other:				
Ores and concentrates:				
Of base metals	[r]132,829	90,993	--	Austria 44,688; Netherlands 18,218; France 10,439.
Of precious metals, n.e.s. value, thousands	$1,382	$137	$137	
Oxides and hydroxides	4,906	565	--	France 453; Spain 78.
Ashes and residues	96,841	66,064	--	Italy 64,967.
Base metals including alloys, all forms	[r]12,062	3,689	787	Japan 2,179; Norway 200.

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	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	(5)	37	1	Italy 36.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$2,499	$393	--	West Germany $272; France $69; Ireland $24.
Grinding and polishing wheels and stones do	$15	$12	--	Canada $6; Republic of Korea $4.
Asbestos, crude	[2]143,027	[2]135,249	4,455	Japan 57,119; Taiwan 14,020; Yugoslavia 9,328.
Cement	60,222	232	209	Netherlands 20.
Clays, crude:				
Bentonite	[2]1,445	[2]1,600	--	Taiwan 1,248.
Chamotte earth	12,314	5,834	--	West Germany 4,925; United Kingdom 808.
Fire clay	1,020	NA		
Flint clay	[2]18,600	[2]14,100	--	NA.
Kaolin	[2]1,297	[2]1,600	--	Taiwan 9.
Unspecified	37,022	6,372	--	Taiwan 2,492; Austria 1,726; Canada 1,021.
Diamond:				
Gem, not set or strung value, thousands	r$1,180,346	$499,656	$356,318	Belgium-Luxembourg $96,207; Hong Kong $33,896.
Industrial stones do	r$21,170	$16,058	$194	West Germany $7,470; Japan $7,467; Spain $308.
Dust and powder do	$1,162	$387	$382	Japan $5.
Feldspar	--	[2]910	--	NA.
Fertilizer materials:				
Crude, n.e.s	226	280	--	Switzerland 144; Japan 136.
Manufactured:				
Nitrogenous	78	24,712	--	West Germany 20,768; Denmark 2,576.
Phosphatic	r1,116	1,486	--	Denmark 1,375; Taiwan 91.
Potassic	113	--		
Unspecified and mixed	r70,584	33,356	40	West Germany 23,684; Netherlands 8,260.
Fluorspar	[2]283,023	[2]288,070	164,726	NA.
Graphite, natural	430	436	73	Taiwan 295; United Kingdom 54.
Gypsum and plaster	r [2]1,599	[2]663	--	NA.
Kyanite and related materials:				
Andalusite	[2]142,143	[2]113,514	--	NA.
Sillimanite	[2]1,467	[2]748	--	NA.
Unspecified	104,819	--		
Lime	--	22	22	
Magnesium compounds:				
Magnesite, crude	419	388	--	Taiwan 311; United Kingdom 72.
Other	1,285	--		
Mica:				
Crude including splittings and waste	r1,116	[6]1,065	--	United Kingdom 516; West Germany 290; Japan 206.
Worked including agglomerated splittings	--	4	--	All to United Kingdom.
Phosphates, crude	619,934	775,199	--	West Germany 257,041; Belgium-Luxembourg 255,483; Denmark 68,848.
Phosphorus, elemental	890	1,716	142	Taiwan 1,375; Belgium-Luxembourg 119.
Pigments, mineral:				
Natural, crude	[2]196	141	--	United Kingdom 101; Belgium-Luxembourg 40.
Iron oxides and hydroxides, processed	119	605	--	Taiwan 539; United Kingdom 53.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$4,783	$16,890	$2,649	Japan $7,501; Taiwan $2,617.
Synthetic do	$376	$60	--	Sweden $29; Spain $13; Italy $12.
Waste and sweepings do	$1,396	--		
Pyrite, unroasted	[2]4,149	--		
Salt and brine	[2]91,639	[2]88,761	--	Netherlands 185.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	18	36	--	All to United Kingdom.
Sulfate, manufactured	r92	133	26	Canada 99.

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	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	r387,118	333,067	--	Italy 99,426; Japan 67,136; France 56,644.
Worked	978	2,956	--	United Kingdom 1,355; West Germany 795; France 543.
Dolomite, chiefly refractory-grade	--	20	--	All to Taiwan.
Gravel and crushed rock	73,590	21	--	United Kingdom 17; Taiwan 3.
Limestone other than dimension value, thousands	$5	--		
Quartz and quartzite	7,186	4,049	--	United Kingdom 3,575; Taiwan 239.
Sand other than metal-bearing	r25,592	18,785	--	Belgium-Luxembourg 15,782; West Germany 1,988.
Sulfur: Elemental, all forms	[2]4,149	--		
Talc, steatite, soapstone, pyrophyllite	303	541	--	West Germany 505; Ireland 18; Sweden 18.
Vermiculite	[2]164,287	[2]190,593	--	France 21,744; West Germany 2,658; Italy 7,722.
Other:				
Crude	r118,438	133,988	--	United Kingdom 39,389; France 21,923; West Germany 16,974.
Slag and dross, not metal-bearing	11,848	89,760	--	Japan 74,857; United Kingdom 14,903.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	r6,256	16,789	--	Taiwan 16,760.
Coal:				
Anthracite and bituminous thousand tons	[2]44,909	[2]45,486	934	Japan 8,835; Italy 5,451; Spain 4,079.
Briquets of anthracite and bituminous coal	71,194	120,987	--	Italy 120,912.
Lignite including briquets	r55,954	25	--	All to Ireland.
Coke and semicoke	261,687	160,622	--	West Germany 77,443; Belgium-Luxembourg 60,964.
Petroleum:				
Crude thousand 42-gallon barrels	96,416	12,025	--	Canada 9,907; Taiwan 1,935.
Refinery products:				
Liquefied petroleum gas do	52	32	--	All to Italy.
Gasoline do	--	1,249	716	Japan 533.
Mineral jelly and wax do	203	[7]234	96	West Germany 59; Japan 22.
Kerosene and jet fuel do	22	388	247	Japan 141.
Distillate fuel oil do	123	521	--	All to Spain.
Lubricants do	6	3	([8])	West Germany 1; Taiwan 1.
Residual fuel oil do	1,173	296	--	Canada 189; Japan 95.
Bitumen and other residues do	47	--		
Petroleum coke do	([8])	136	--	Italy 116; Belgium-Luxembourg 16.

rRevised. NA Not available.

[1]Table prepared by Virginia A. Woodson. 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 data issued by the Department of Mineral and Energy Affairs and official trade returns of trading partner countries. Data issued by the Government of the Republic of South Africa are footnoted; other figures are compiled from a variety of sources with specifics on destination obtained from the import statistics of the trading partners. Data presented are exports by the common customs area of Botswana, Lesotho, the Republic of South Africa, and Swaziland. Comparable import data for 1986 were not available at the time of publication.

[2]Data issued by the Government of the Republic of South Africa.

[3]Excludes unreported quantity valued at $329,000 imported by Sweden.

[4]Unreported quantity valued at $351,000.

[5]Unreported quantity valued at $3,000.

[6]Excludes unreported quantity valued at $29,000 imported by Japan.

[7]Excludes unreported quantity valued at $61,000 imported by New Zealand.

[8]Less than 1/2 unit.

Table 3.—Republic of South Africa: Value of domestic sales and exports of major mineral commodities

(Thousand U.S. dollars)

Commodity	Domestic sales			Exports		
	1985	1986	1987[p]	1985	1986	1987[p]
METALS						
Antimony	7,741	NA	NA	2,820	NA	NA
Chromite	41,199	51,428	68,502	67,085	43,508	65,974
Copper	98,788	109,392	121,905	152,724	138,849	198,717
Gold	(1)	(1)	(1)	6,978,847	7,618,477	8,628,625
Iron ore	69,814	76,747	99,761	145,708	132,067	131,845
Lead concentrate	--	--	--	21,731	25,459	37,256
Manganese	25,049	30,051	29,875	111,305	89,504	57,077
Nickel	33,501	20,999	45,383	37,785	29,770	75,351
Silver	647	1,763	1,428	33,588	30,845	35,225
Tin	10,876	6,331	7,560	11,568	7,069	3,779
Titanium	13,133	e14,000	NA	19,470	e22,000	NA
Uranium[e]	NA	NA	NA	200,000	150,000	NA
Vanadium	e3,500	e3,800	NA	e60,000	e65,000	NA
Zinc	29,859	23,280	46,431	5,442	10,593	5,477
Zirconium	540	NA	NA	29,369	e30,000	NA
INDUSTRIAL MINERALS						
Asbestos	1,715	2,116	3,550	44,973	41,547	49,327
Cement[e]	350,000	r275,000	NA	35,000	30,000	NA
Clays:						
Flint	4,446	2,294	3,613	1,372	1,069	1,156
Other	4,859	6,447	8,441	106	120	48
Diamond	(1)	(1)	(1)	353,557	465,501	NA
Feldspar	1,888	2,440	3,167	--	75	334
Fluorspar	2,062	2,466	4,539	23,734	24,872	26,634
Granite	1,003	1,326	3,588	15,947	20,546	34,502
Gypsum	3,053	3,167	3,487	8	4	--
Kyanite-related materials:						
Andalusite	4,398	6,242	6,120	11,411	9,823	13,024
Sillimanite	17	46	6	134	80	170
Lime products	56,545			2,283		
			101,757			2,499
Limestone	34,345			78		
Magnesite	1,002	1,957	2,239	--	--	--
Mica	213	278	362	303	257	547
Phosphate rock	37,714	e35,000	NA	16,532	e15,000	NA
Pyrite-sulfur	19,097	26,064	NA	89	--	--
Salt	17,168	18,833	21,158	2,018	2,253	2,217
Silica, sand	10,881	12,967	18,169	28	17	23
Slate	1,047	1,118	711	2,575	2,928	1,395
Stone, other	1,090	1,203	4,964	187	267	48
Vermiculite	261	250	282	12,630	15,095	15,367
Wonderstone	521	98	222	--	--	--
Miscellaneous	197,326	90,569	503,712	791,513	1,187,380	2,266,838
MINERAL FUELS						
Coal:						
Anthracite	14,394	12,681	16,267	129,455	132,472	88,312
Bituminous	861,070	958,388	1,227,270	1,302,949	1,259,245	1,026,410
Total	1,949,762	1,901,098	2,384,960	10,624,324	11,088,687	12,769,253

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Value, if any, is included under exports.

Sources: Republic of South Africa Department of Mineral and Energy Affairs, South Africa's Mineral Industry 1986; Minerals Bureau, Mineral Production and Sales Statistics, 1986 and 1987.

COMMODITY REVIEW

METALS

Aluminum.—Alusaf (Pty.) Ltd., the sole producer of aluminum and 66% owned by the Industrial Development Corp., was again mentioned for possible privatization by the Government. A method to market the shares and the extent of continuing Government ownership in the company was yet to be decided. Alusaf exported about 50% of its annual output of about 170,000 tons of aluminum metal.

Antimony.—Consolidated Murchison Ltd.'s antimony and gold output was adversely affected by a NUM strike in August and September, which lasted for 18 days.

Production losses included 500 tons of antimony concentrate and 640 ounces of gold. Gold head grade also declined until December owing to a change in mining areas. Output from the Monarch East shaft at yearend had higher gold content, reversing the declining trend. Although primarily an antimony producer, the company was exploring for gold in the Murchison greenstone belt.

Chromite.—Chromite output by South African Manganese Amcor Ltd. (Samancor), was through its 51%-owned Cromore Ltd. from seven mines. Cromore Ltd. reactivated the Jagdlust Mine following a period of care and maintenance after its purchase from Union Carbide Corp. in 1986. Samancor accounted for about 50% of total chromite exports. About 65% of total chromite output by Samancor was for production of high-carbon ferrochromium and intermediate-charge ferrochromium at its ferroalloy plants.

The Chroombronne Mine at Kroondal was owned by Erts Handel (Pty.) Ltd., 50%, and Chromecorp Technology, 50%. Production capacity was to increase to about 250,000 tons per year from 100,000 tons per year. The labor force was 250. Output was slated for a new charge chrome smelter near Rustenburg.

Copper.—Lower concentrate grades and underutilized refinery capacity has caused Palabora Mining Co. (PMC) to increase output by 19% to about 140,250 tons of cathode per year. The increase was part of a $6 million expansion project that included modification of the reverberatory furnace and increased throughput of concentrates to the smelter. PMC expanded ore output by decreasing the waste-to-ore ratio of its in-pit mining operation as it proceeded toward termination of open pit mining and commissioning of an in-pit crusher and conveyor system in mid-1988.

Gold.—The average grade of gold mined was lowered to 0.170 troy ounce per ton from 0.181 ounce per ton owing to an 8% increase in the price of gold in 1987. Total ore milled was 107.6 million tons.

Total working revenue of the gold mines, which were members of the Chamber of Mines, was $7.77 billion, or $78.81 per ton of ore milled, equivalent to $464.26 per ounce of gold recovered. The average production cost per ton of ore milled was $46.63, equivalent to $274.65 per ounce produced. An average working profit of $32.17 per ton of ore milled was realized, or $189.49 per ounce of gold recovered.

Nearly 150 exploratory drilling rigs were operational in the Witwatersrand Basin at a cost of about $147 million. Exploration was concentrated on the Potchefstroom area, where gold-bearing formations were at depths of about 4,000 meters. A borehole in the Mooi River area intersected the Bird Reef at 3,184 meters, and assayed 0.68 ounce per ton over a thickness of 83 centimeters. Although grades appear comparable with currently mined ores, western portions of the Witwatersrand Basin are extensively faulted, resulting in difficult mining conditions. Rhombus Exploration Co. intersected rock identified as being part of the lower Witwatersrand group at 2,200 meters depth. The area is 100 kilometers south of the closest gold mine in the basin, Beatrix Mine, and could substantiate the theory that the new area is part of the Witwatersrand gold-bearing basin. It represents a major new gold mining area with potentially large reserves. Capital expenditure by existing and new gold producers was estimated at $1.5 billion.

Reclamation of sand and slime accumulations from the Witwatersrand Goldfields continued, and the total gold resource available in these accumulations was estimated at 42 million ounces. Sand dumps in the Central and West Rand areas contained about 0.022 ounce per ton, and slimes dams in the East Rand were estimated to contain 0.026 ounce per ton.

Sevmin, which took over 14 mining projects covering various minerals from Utah International Co. (formerly Utah Mining Co.) of the United States, commenced reopening of the Eersteling gold mine near Pietersburg, well outside the Witwatersrand Basin. Shaft sinking to a total depth of 300 meters commenced in early 1987 and the first gold output was expected in 1988. Output would be 10,000 tons of ore per month. Reserves were about 2.4 million tons and average recovery grade was estimated at 0.16 ounce of gold per ton. Recovery would be by the carbon-in-pulp process and total project cost was $10 million.

Table 4.—Republic of South Africa: Gold production and ore reserves, by producer

Producer	Production (troy ounces)				Developed ore	
	1984	1985	1986	1987[p]	Thousand metric tons	Troy ounces per ton
AAC Joint Metallurgical Scheme	129,066	121,777	88,199	87,842	NA	NA
Barberton	56,521	55,945	53,740	55,331	NA	NA
Blyvooruitzicht	501,381	426,084	425,617	383,069	1,948	0.463
Bracken	110,042	122,333	98,703	84,878	1,120	.190
Buffelsfontein:						
Buffelsfontein section	1,011,519	1,230,771	1,128,888	549,285	7,897	.322
Beatrix section	--	--	--	395,293	3,610	.248
Consolidated Murchison Ltd	25,302	[e]27,000	26,942	[e]25,000	NA	NA
Deelkraal	234,642	231,032	243,947	264,475	4,754	.209
Doornfontein	314,906	306,528	278,464	259,276	6,211	.240
Driefontein Consolidated Ltd.:						
East Driefontein	1,110,646	914,205	888,321	1,060,790	8,141	.519
West Driefontein	1,238,930	1,157,435	1,033,182	1,053,257	7,962	.470
Durban Deep	244,734	242,645	239,790	231,389	4,163	.135
East Rand Gold and Uranium Co. Ltd. (Ergo)	207,694	222,965	280,386	254,601	NA	NA
East Rand Proprietary Mine	335,017	329,590	296,539	284,241	11,225	.190
Elandsrand	343,813	378,430	380,536	351,031	4,457	.325
Free State Geduld	860,009	857,626	[1]	[1]	[1]	[1]
Freegold:						
North region	[1]	[1]	1,715,719	1,523,879	18,620	.364
South region	[2]	[2]	1,707,974	1,629,809	25,949	.306
Grootvlei	247,445	220,342	184,384	145,990	1,390	.213
Harmony	1,037,310	1,057,147	923,690	894,915	27,226	.169
Hartebeestfontein	996,778	926,921	993,855	1,015,769	17,597	.392
Kinross	432,748	473,474	397,238	381,211	7,280	.286
Kloof	1,048,190	1,001,173	927,258	969,344	5,663	.694
Leslie	148,170	125,507	112,302	105,294	920	.238
Libanon	285,440	282,116	287,157	273,660	5,112	.191
Loraine	278,271	286,604	280,804	262,221	11,114	.228
Marievale	38,790	36,533	32,344	26,743	430	.178
President Brand	726,580	670,869	[2]	[2]	[2]	[2]
President Steyn	783,615	738,752	[2]	[2]	[2]	[2]
Randfontein	998,781	1,035,606	869,966	761,554	13,541	.188
St. Helena	396,843	397,441	313,244	285,530	6,390	.326
St. Helena-Beisa	40,526					
Stilfontein	346,623	319,215	275,072	231,482	3,215	.294
Unisel	291,385	298,391	302,442	241,870	3,650	.260
Vaal Reefs	2,659,969	2,615,636	2,620,327	2,337,700	31,046	.401
Venterspost	203,315	188,844	189,782	21,884	7,459	.174
Western Areas	567,878	527,657	516,790	410,211	6,692	.170
Western Deep Levels	1,158,907	1,204,613	1,196,009	1,102,647	7,190	.601
Western Holdings	1,252,472	1,244,062	[1]	[1]	[1]	[1]
West Rand Consolidated	140,142	130,457	125,163	127,458	4,051	.231
Winkelhaak	471,709	445,956	442,419	383,494	9,450	.280
Witwatersrand Nigel	25,984	26,171	40,510	[e]40,000	NA	NA
Other	558,828	687,377	592,146	535,194	NA	NA
Total or average	21,860,921	21,565,230	20,513,665	19,227,887	275,473	.297

[e]Estimated. [p]Preliminary. NA Not available.
[1]Free State Geduld and Western Holdings are included with Freegold, north region, commencing in 1986.
[2]President Brand and President Steyn are included with Freegold, south region, commencing in 1986.

Sources: Chamber of Mines of South Africa. Quarterly Analysis of Working Results, Oct.-Dec. 1982-87; supplements to the Mining Journal (London), 1982-87. Consolidated Murchison Ltd. Annual Reports 1982-85.

The Springs Dagga and Consolidated Modderfontein gold mines, with a 5.5 kilometer-long common boundary, were merged in April under the management of Golden Dumps Ltd. The company also acquired the Langlaagte Mine with a reported mine life of 30 years, and commenced construction of a 6,000-ton-per-month carbon-in-pulp plant. Reserves were 21 million tons of ore in three horizons and the grade was 0.113 ounce per ton. About 12 to 14 million tons of potentially minable waste dumps existed at the surface.

AAC's Western Deep Mine, a major gold producer, suffered serious damage at several stoping levels during the strike by NUM owing to uncontrolled rock pressure. Production startup in these stopes was delayed several months.

A number of new or rejuvenated gold mines were under way outside the Witwatersrand Basin. AAC and BRL commenced development of the Barbrook Mine in the Barberton gold mining area, each having 50% of the operating company, Barbrook Mines Ltd., at a cost of $47 million. Reserves

were 14.9 million tons averaging 0.23 ounce per ton in situ and 0.14 ounce per ton recovered. Output would be 25,000 tons per month with commissioning scheduled for late 1989 and full production by 1990. Recovery would be by roasting the refractory ore, cyanidation, and carbon loading of gold in the leachate.

Also in the Barberton area, Gencor commenced a full-scale bacterial leach plant at the Fairview Mine. *Thiobacillus ferrooxidans* was used to treat 300 tons of concentrate per month containing refractory minerals, converting pyrite and arsenopyrite to sulfuric acid and iron sulfate. Yield was 3.22 to 4.82 ounces per ton at 95% recovery, compared with 90% recovery for roasting and acid leaching. Capital expenditures were put at 60% of the $3.2 million required for a modern roaster.

Gencor also commenced opening of the Oryx Mine, a major large mine, on the closed Beisa uranium mine property for about $0.74 billion. Gencor owned 55%, and Genbel Investments 10% of the mine; the remainder was held by African Selection Trust, a subsidiary of British Petroleum Minerals Corp., and AAC. Use of the existing shaft system and infrastructure of the Beisa Mine would save about $49 million. The mine shafts at Beisa Mine, which extend to 1,070 meter depth in the main shaft, were to be dewatered and ore production would commence from the Beisa Reef at 15,000 tons per month starting in July 1988. Subvertical shafts would be sunk to 2,400 meters depth to access the Kalkoenkrans Reef. A phased increase to 100,000 tons per month was expected, with a target output of 220,000 tons per month planned in 1994 from the commissioning of a second shaft system from the surface. Total employment would be about 7,000. Ore reserves were estimated at 52 million tons grading 0.29 ounce in situ and 0.25 ounce recovered.

JCI completed mechanization programs at its Randfontein and Western Areas Mines. About 50% and 70%, respectively, of ore output by these mines was now from trackless mining. Strikes and work stoppages occurred at the mines during implementation of the programs as a number of workers were retrenched.

Iron and Steel.—The Iron and Steel Corp. of South Africa Ltd. (Iscor), expected its new direct-reduction plant near Pretoria to come on-stream in early 1988, using steam coal from the Transvaal instead of coking coal, which was in short supply. Iscor successfully researched and developed new technology for the utilization of noncoking coals in iron ore reduction in place of coke. Iscor's Vanderbijlpark steelworks was struck by 6,500 members of Numsa in July over wage rates. Contingency plans to ensure against disruption in output were put into effect, and there were no reports of production losses.

Middleburg Steel and Alloys (Pty.) Ltd. (MSA) planned to expand its stainless steel production capacity at Krugersdorp as part of a $79 million program over the next 2 years. Production was about 100,000 tons per year with nearly 50% sold domestically. MSA's 3CR12-grade stainless steel gained wider acceptance with the development of a compact, portable, compressed air-plasma cutter. The steel and the cutter were being used by the President Steyn Mine for all its ore cars.

Highveld Steel and Vanadium Corp. commissioned a new 63-megavolt ampere (MV•A) submerged-arc furnace at its No. 2 ironmaking plant. The furnace was supplied and commissioned by Mannesmann Demag AG, and was expected to produce 600 tons per day of pig iron. After prereduction of the ore at 1,000° C, the furnace is charged automatically with iron ore and is computer controlled.

Ferroalloys.—The Meyerton plant of Metalloys Ltd., 100% controlled by Samancor, increased production of ferrosilicomanganese by reducing ferromanganese output, which faced a declining market. Metalloys Ltd. dismissed 1,100 workers or about 65% of its labor force in early August because of illegal strike action by NUM. The strike was in sympathy with other strikes nationwide. The Meyerton plant had an annual capacity to produce about 500,000 tons of ferromanganese or 300,000 tons of ferrosilicomanganese, and about 15,000 tons of ferrosilicon. The impact on output by the strike was not known.

Heavy worldwide demand for stainless steel resulted in near full capacity utilization for production of ferrochrome at about 1 million tons per year. Chromecorp Technology was building a 120,000-ton-per-year, $26 million ferrochrome smelter near Rustenburg. Two 30-MV•A ampere submerged-arc furnaces would be used. Chromite for the smelter was to come from the Chroombronne Mine 18 kilometers distant.

MSA continued to expand its ferrochrome and stainless steel plants. Its plasma arc

furnace at Krugersdorp was to be upgraded from 16 MV•A to 40 MV•A, allowing production of an additional 30,000 tons to 45,000 tons per year of ferrochrome from chromite fines.

Ferrometals (Pty.) Ltd., also 100% controlled by Samancor, operated at full capacity, employing 1,000 workers on three 8-hour shifts, 7 days per week, owing to strong demand for ferrochromium in the first quarter of 1987. Its new intermediate-charge ferrochrome converter operated at its full rated capacity of 50,000 tons per year. Due to the high cost of electricity at 30% of plant costs, Ferrometals was investigating the use of a Krupp direct-reduction process. Options were refitting of its No. 2 or No. 3 furnaces at a cost of about $6 million or building a new unit costing about $22 million. Ferrometals held 49% of Tubatse Ferrochrome (Pty.) Ltd., which also produced charge chrome. Nearly all charge chrome output by Ferrometals, Crometals (Pty.) Ltd., and Tubatse was exported. Ferrometals also produced 75% ferrosilicon at its Witbank plant and 15% ferrosilicon at its Meyerton plant. Both products were sold domestically and overseas. Its 15% ferrosilicon was used as heavy medium in the recovery of diamonds, iron ore, and uranium.

Samancor had a 10-year contract to market ferrochromium produced at the Batlhako plant in Bophuthatswana. Output was 60 tons per day from a single 12.5-MV•A submerged-arc furnace, and was shipped to Samancor's Ferrometals plant at Witbank for crushing and sizing prior to export to Taiwan via the ports of Richards Bay or Durban. Feed material of about 4,000 tons per month of chromite was from Samancor's wholly owned subsidiary Batlhako Mining Ltd., which operated the Ruighoek Mine, also in Bophuthatswana. Metallurgical coke was from the Hlobane Colliery in Natal, supplemented by low phosphorus coal. The total labor force was 103 people.

Magnesium.—All magnesium requirements were met through imports and amounted to 1,089 tons for 1986, the latest year available. Work commenced on a demonstration plant to produce magnesium from domestic ore using transferred arc technology. A 100-kilowatt furnace would have a daily throughput of about 500 kilograms of raw material to yield 50 kilograms of metal. Satisfactory results were obtained from a pilot plant in August 1985. Total import savings were estimated at about $5 million, with the potential for export of excess product.

Manganese.—The Manganese Metal Co. (Pty.) Ltd. (MMC) operated two manganese metal plants at Krugersdorp and Nelspruit with a total capacity of 40,000 tons per year using a hydrometallurgical process. Powdered manganese ore was reduced in a rotary kiln and leached in recycled acid. Following solution clarification and precipitation of deleterious metals, electrolysis produced high-purity manganese metal. After 20 hours of deposition, cathodes were stripped of manganese metal by hand using a rubber mallet. Degassing of the flakes occurred in a rotary kiln, and the final product was sized and packed in 500-kilogram drums.

Samancor's manganese mines in northern Cape Province operated well below their capacity of 4.5 million tons per year in the first quarter of 1987 owing to reduced demand for lumpy ore. The opencast Mamatwan Mine operated at 50% capacity, producing about 65,000 tons per week of 37% to 38% manganese ore in both fine and lumpy form. Overburden was 45 meters and the stripping ratio was 2:1. Proved reserves were 5.6 billion tons and probable reserves were 13.6 billion tons. About 500,000 tons per year was exported and the remainder was shipped to Samancor's Metalloys Ltd.'s plant at Meyerton for blending with Wessels Mine ore in the ratio of 70:30 for the production of ferromanganese. Work on a $30 million sinter plant continued and was planned for completion in 1988. Sintered ore will replace lumpy ore at the Meyerton plant, thereby reducing electricity and carbon reductant needs, as well as transport mileage. A heavy-medium separation plant costing $2.5 million was also planned to improve shipment grades. Current railroad transport charges to Port Elizabeth from northern Cape Province were $15 per ton of ore.

The underground Wessels Mine was accessed via a vertical shaft and two incline shafts to a depth of 370 meters. Mining was by room-and-pillar method using trackless equipment, and production capacity was 1.2 million tons per year. Scoop loaders discharged blasted ore into 30-ton haulers, which transported the ore to four underground primary crushers. Conveyers with a capacity of 700 tons per hour moved primary crushed ore to underground secondary crushers and finally to underground

storage silos. Ore from the Wessels Mine graded up to 60% manganese owing to hydrothermal alteration from structural deformation, and mine life was estimated at 70 years. A pilot plant to sort specific grades of ore using X-ray fluorescence was operating at the rate of 30 tons per hour. Output of 200 tons per hour was required for a commercial operation.

The Hotazel Mine neared the end of its reserves and output was about 7,000 tons per month grading more than 50% manganese.

Platinum-Group Metals (PGM).—Rhombus Mining and Exploration Co. Ltd., which holds leases in the Bushveld Igneous Complex, location of the country's principal reserves, was listed on the Johannesburg Stock Exchange for the first time. Capital obtained through both private and public listing of company shares was to be used primarily for its PGM prospect in northern Transvaal. The company was in litigation with the Government over Messina Ltd.'s acquisition of the same prospect for development.

Total revenue for Rustenburg Platinum Holdings (RPH) was $1.08 billion in the year ended June 30, 1987. RPH concluded an agreement with the Lebowa Development Corp. (LDC) to exploit PGM resources located in Lebowa, site of a portion of the northeastern limb of the Bushveld Complex. LDC obtained 7.5% of the share capital of Atok Mine, which was to be listed on the Johannesburg Stock Exchange as Lebowa Platinum Mines (LPM). Output would be 50,000 tons of ore per month from the Merensky Reef and 10,000 tons per month from the UG2 chromitite horizon. LPM also had an option to exploit the Maandagshoek deposit, commencing at 50,000 tons of ore per month. Expansion to 100,000 tons per month within 5 years would allow LPM access to additional reserves. Successful development of these deposits would result in recovery of about 300,000 troy ounces of PGM per year, and allow RPH access to the Plat Reef in Lebowa for development of additional PGM resources.

Matthey Rustenburg Refinery Ltd. relocated its refinery to Bophuthatswana from Wadeville.

Golden Dumps Ltd. continued work on the Lefkochrysos Mine near Brits through Lefkochrysos Platinum Ltd., following JCI's loss of mineral rights to the deposit owing to its nondevelopment of the site. Revised development plans included startup at year-end 1988, primarily from the UG2 ore horizon, and output of about 160,000 tons of ore per month and 300,000 ounces of PGM per year. PGM composition was expected to be 50% platinum, 25% palladium, 9% to 10% rhodium, and about 15% minor PGM. Reserves were 125 million tons grading 0.19 ounce per ton. Mine and plant costs were estimated at $100 million.

Northam Platinum Ltd. continued development of its major new underground PGM mine in the western limb of the Bushveld Complex, sinking its No. 1 and No. 2 shafts to 262 meters and 517 meters below collar, respectively.

BRL formed Barplats Investments Ltd. to hold the joint platinum interests in Rhodium Reefs and Vansa. Barplats will own the entire share capital of Rhodium Reefs, which was developing a platinum deposit below the vanadium-magnetite deposit of Vansa at Kennedy's Vale near Steelpoort.

Silicon.—The sole production of silicon metal in Africa was by Silicon Smelters Ltd. High-quality quartz was mined at Pietersburg in the northern Transvaal and converted to silicon metal at nearby Silicon Smelters Ltd. The smelter operated at full capacity, and nearly all output was exported for use in the manufacture of aluminum and silicone.

Titanium.—Rhombus Mining neared completion of assessment of titanium sand deposits about 20 kilometers north of the mouth of the Kei River in the Transkei region. Planned annual production capacity was 300,000 tons of ilmenite, 25,000 tons of rutile, and 30,000 tons of zircon. Reserves were estimated at 250 million tons containing 6% heavy minerals, of which 5.2% was ilmenite, 0.4% rutile, and 0.5% zircon. Sevmin announced that it may commence production of ilmenite, rutile, and zircon in the Mtunzini area, Natal Province. A decision to proceed with a small-scale operation was to be made in March 1988.

Vanadium.—Total exports of vanadium were reported at $94.6 million. The first stage of the $25 million vanadium project at Kennedy's Vale for Vansa Vanadium Ltd., consisting of massive foundations for a rotary kiln, plant, workshop, and storage buildings valued at $1.5 million was completed. Initial mine output was planned for early 1988.

Zinc.—The Pering Mine of Shell South Africa Ltd. reached its target production rate of 1.1 million tons of ore milled per year, yielding 60,500 tons of zinc concen-

trate grading 55% zinc, and 9,000 tons of lead concentrate grading 65% to 68% lead. Reserves were estimated at 18.4 million tons grading 3.60% zinc and 0.64% lead. Demonstrated reserves were 23.4 million tons averaging 1.13% zinc and 0.28% lead. The deposit was mined as an open pit, and several grades of rock were mined and stockpiled for possible future processing. Recovery rates of mill feed were expected to be 92% for zinc and 86% for lead. All lead concentrate sales were under contract for a 3-year period to the Tsumeb smelter in Namibia, a rail journey of 1,600 kilometers. Prices for zinc were based on European producer prices and for lead on the London Metal Exchange. The labor force was 215 people with a monthly wage cost of $157,200. Electric power costs were about $100,000 per month; mining costs were about $6.19 per ton, and transport costs about $1.08 per ton.

Zirconium.—Palabora Mining Co. Ltd. produced 7,124 tons of baddeleyite in 1987 compared with 11,522 tons in 1986 owing to unplanned maintenance. Low-grade feedstocks from the commissioning of a new copper cleanup unit also adversely affected output. The unit was a copper flotation column designed to remove additional copper contamination from crude zircon concentrates; it resulted in the recovery of 180 tons of copper sulfide. Output of zirconium oxide for coloring in ceramics was 785 tons, compared with 851 tons in 1986. The acid-zirconium-sulfate-tetrahydrate (AZST) plant produced 1,530 tons of product. Baddeleyite and AZST were not used domestically; however, about 1,000 tons of premium-grade material and 4,000 tons of standard-grade material were consumed locally.

INDUSTRIAL MINERALS

Cement.—Production continued to be well below capacity owing to low demand domestically and the high cost of transport for export shipments. Sinter production capacity was 11.16 million tons and cement production capacity was 12.02 million tons.

Diamond.—Total marine diamond output, including that from offshore Possession Island, was 66,875.4 carats, compared with 45,964.3 carats in 1986 and 54,618.1 carats in 1985. Mining early in the year was adversely affected by an abnormally virile plankton population that obscured visibility. Marine West Corp. (Mervest), which operated out of Port Nolloth to its offshore diamond-mining areas, had a total of 13 vessels in its exploitation program. Gravel pumped aboard were bagged for processing ashore. As the company's properties were no longer concessions with a 5% royalty due, but actual mining areas, Marine West had to pay 25% of profits to the government before payment of the company tax, which was 58%. Approximately 70% of earnings was paid to the Government.

An additional 13 marine diamond concessions were allocated off the west coast of the Republic of South Africa, and 14 companies or individuals continued to work concessions that were issued in 1983 and 1984. Five shore-based concerns were also working marine areas.

Table 5.—Republic of South Africa: Marketed diamond output, by Province

Province	1985		1986		1987[p]	
	Output (carats)	Price per carat	Output (carats)	Price per carat	Output (carats)	Price per carat
Mine diamond:						
Transvaal	2,700,601	$22.45	2,884,380	$24.07	2,491,283	NA
Cape Province	6,147,626	30.27	6,077,429	34.84	5,172,524	NA
Orange Free State	68,143	64.73	31,929	94.67	22,204	NA
Total or average	8,916,369	28.34	8,993,738	31.60	7,686,011	NA
Alluvial diamond:						
Transvaal	52,617	161.78	47,422	178.71	36,411	NA
Cape Province	1,232,406	94.63	1,186,042	122.04	1,327,441	NA
Orange Free State	1,079	359.50	2,130	500.15	992	NA
Total or average	1,286,102	97.85	[1]1,235,593	124.87	1,364,844	NA
Grand total	10,202,471	36.75	10,229,331	42.87	9,050,855	NA

[p]Preliminary. NA Not available.
[1]Data do not add to total shown because of independent rounding.

Sources: Minerals Bureau, Mineral Production and Sales Statistics, 1985, 1986, and 1987. R1=$0.4564 for 1985, R1=$0.4408 for 1986, and R1=$0.4856 for 1987.

The Department of Mineral and Energy Affairs announced commercial startup of an alluvial diamond mine near Lichtenburg in western Transvaal. Development would be by Shenandoah (Pty.). Throughput to rotary pans would be 900 tons per day at full production. Infrastructure and mine development have been under way for 2 years.

Frigate Mining Co. commenced strip mining at the Klipdam Mine near Kimberley. Output was not reported but reserves were expected to last 5 years. The company also had interests in coal and gold.

Dolomite.—Output was by Lyttelton Dolomite Ltd., a subsidiary of Samancor, at its Verwoerdburg deposit in the Transvaal. Near full capacity was reached with sales of stone products to the metallurgical and construction industries, and powder for rockdust to the coal-mining sector. A dolomite deposit was acquired at Irene, south of Verwoerdburg, and remained to be exploited.

Fertilizer Materials.—Langfos and langfos mixtures were produced at Langebaan in western Cape Province. Expenditures by Samancor totaled $750,000 for the construction of a mixing plant at Driemanskap in the Transvaal to produce langfos mixtures.

Granite.—Kudu Granite Co., near Rustenburg, expanded marketing of black and grey granite mined from the eastern and western limbs, respectively, of the Bushveld Complex. Shipments were via Durban to ports in Europe and Asia, and were valued at $1.5 million.

Keeley Granite Co. was expanding output of black granite to more than 50,000 tons per year. About 20 quarries were worked for the premium quality black granite in the Belfast area in the eastern Transvaal. The company signed a $12 million, 12-month-delivery contract for the supply of 60,000 tons of various granite types for shipment to Europe. Red granite from two quarries near Potgietersrus was shipped to the Far East. About 90% of the company's total annual output of nearly 200,000 tons was exported to about 20 countries.

Gypsum.—Pretoria Portland Cement Ltd.'s (PPC) synthetic gypsum plant at its Jupiter cement works used sulfuric acid derived from Zinc Corp. of South Africa Ltd.'s operation and locally produced limestone supplied from PPC's slurry plant near Mafikeng. The limestone was fine ground and dissolved in 70% sulfuric acid in a paddle mixer. The resulting magnesium sulfate, carrying only traces of acid, was transferred by conveyor to a storage area for a curing period of 3 days. Neutralization and water absorption resulted in gypsum crystals for use in cement manufacture.

Phosphate Rock.—Yellow phosphorus and phosphoric acid were produced at Samancor's Meyerton plant. All phosphoric acid production was sold locally; about 60% of yellow phosphorus production was exported.

Serpentine.—Production by Samancor from the Honingklip deposit near Krugersdorp in the Transvaal ceased owing to a change in production process by ferroalloy producers, the main consumers. Rehabilitation of the mining area was under way.

Silica.—Quartz was mined near Delmas in the Transvaal by Delmas Silica Co. (Pty.) Ltd., a subsidiary of Samancor, for use in the ferroalloy, building, and refractory industries.

Soda Ash.—All consumption was from imports, mainly from the United States, as there was no domestic mining of soda ash. Research on development of the Sua Pan deposit in Botswana was completed with the assistance of local companies, and construction of a synthetic soda ash plant in southern Cape Province was also considered, but no decision on commencing either project was made by yearend.

Sulfur.—Daily capacity was 70 tons for Mobil Refining Co. of Southern Africa's plant at Durban, 90 tons for National Petroleum Refiners of South Africa's plant at Sasolburg, and 106 tons for Shell and British Petroleum South Africa petroleum refineries plant at Durban.

MINERAL FUELS

At yearend 1986, the latest year for which comprehensive data were available, the country had a total power station capacity of 26,682 megawatts. Twenty stations were coal-fired with a total capacity of 22,912 megawatts, two were hydroelectric with 540 megawatts capacity, three were gas turbine or diesel with 390 megawatts capacity, one was nuclear with 1,840 megawatts capacity, and one was pumped-storage with 1,000 megawatts. The Electricity Supply Commission (Escom) had five coal-fired stations on order with a total installed power rating of 16,347 megawatts, and a pumped-storage station was planned with 400 megawatts installed capacity. Coal consumption in domestic powerplants was 58.9 million tons in

1986, at an average cost of $6.55 per ton. Of total sales of electricity of 117,353 gigawatt-hours, 27.1% was for mining, 33.4% was for industry and commerce, and 3.8% was for traction. Total electricity sales to the mining sector were up 3.3% to 31,860 million kilowatt-hours, of which 71% was for gold and uranium mining, 11% for platinum mining, 6% for coal mining, 4% for copper mining, and 2% for diamond production. Total sales to industry were down slightly to 30,959 million kilowatt-hours, of which 48% was for iron, steel, and base metals; 23% was for chemicals; and 5% was for building, cement, and quarrying. A small quantity of electricity was purchased from outside the Republic of South Africa, and about 4,000 gigawatt-hours was sold to neighboring countries.

Coal.—A process that utilized waste coal in a fluidized bed was successfully developed by the National Institute for Coal Research and was being made available to industry. About 44 million tons of waste coal was produced annually from normal coal-mining operations.

The likelihood of exploitation of coking coal reserves in the protected Kruger National Park were decreased as Iscor successfully utilized noncoking coal to reduce iron ore, and was building a direct-reduction plant for this purpose. Coal producers exporting through Richards Bay experienced increased rail-shipment costs from the South African Transport Services of 20% to 22% at yearend. Rail tariffs were increased about 66% overall in 1987, to $11.60 per ton compared with $6.87 per ton in 1986 for coal from Witbank. The price increases to current coal shippers was reportedly made to more rapidly recover the cost of having expanded port facilities at Richards Bay to 44 million tons per year during phases 1 thru 3. Phase 4, which would allow expansion to 65 million tons of coal exports per year, had been delayed. The export price per ton of coal for March 1987, the last available data, was $30.27 compared with estimated production, shipping, and handling costs of $21.38.

Gencor expected to increase coal production through its Trans-Natal Coal Corp. in order to meet the needs of its expanding oil-from-torbanite project in the eastern Transvaal.

BRL's new Majuba colliery commenced installation of a 64-ton cage having four 16-ton-capacity clamps to act as brakes for safety. The cage had the capacity to move 300 people at up to 3 meters per second in the mine's 320 meter deep shaft. It would also be used for drive-on, drive-off equipment such as continuous miners, engines, shuttle cars and load-haul-dump vehicles.

Petroleum.—In February, the Government approved a $2.7 billion Mossel Bay gas-development project. Located about 85 kilometers offshore of Mossel Bay in 100 meters of water and 3,000 meters below the ocean floor, the F-A area was to be serviced by a single collection-and-conversion platform. The area had 18 wells drilled within a 4.2-kilometer radius. About $150 million was budgeted for engineering and planning work in 1987-88, which included plans for gas and condensate distillation and separation into dry gas and liquid condensate for transport via separate pipelines to an onshore synthetic-fuels plant. Reserves were estimated to last 17 to 19 years, at which time a separate production platform would be erected on the E-M area with pipelines linking the original separation plant.

Energy Resources and Mining Corp., a subsidiary of Johannesburg Mining and Finance Corp., commenced drilling three wells in the vicinity of Kinkelbos near Port Elizabeth. Southern Oil Exploration Corp. (Pty.) Ltd. (Soekor) discovered a small quantity of oil in the area known as Algoa Basin in 1972, and later seismic work by Israeli consultants confirmed the existence of four oil traps. Depth of the traps was estimated at 2,900 meters, and recoverable reserves were about 100 million barrels.

Soekor's offshore drilling rig, Omega, completed refitting and was towed to a new exploration site south of Algoa Bay. Two other rigs were operational, one west of Hondeklip Bay and the other west of the mouth of the Orange River.

Uranium.—Total uranium ore processing capacity was 8,300 tons per year of contained U_3O_8. An additional 2,000 tons per year of uranium capacity was closed owing to low world prices. Capacity to refine uranium to uranium hexafloride was 700 tons of contained uranium per year.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from South African rands (R) to U.S. dollars at the rate of R1 = US$0.4408 for 1986 and R1 = US$0.4914 for 1987.

Table 6.—Republic of South Africa: Production of U_3O_8, by producer

(Kilograms)

Company or mine	1983	1984	1985	1986[P]	1987[P]
AAC Joint Metallurgical Scheme[1]	718,928	596,787	602,104	529,811	462,786
Blyvooruitzicht	289,156	233,092	--	--	--
Buffelsfontein	611,000	613,500	713,500	597,000	446,900
East Rand Gold and Uranium Co. Ltd. (Ergo)	229,885	216,131	150,997	155,780	116,516
Harmony	623,600	496,680	426,300	330,243	178,100
Hartebeestfontein	441,446	436,283	428,367	465,059	415,324
Palabora copper	218,635	159,769	217,828	185,443	176,000
Randfontein	491,067	592,776	609,332	600,498	461,992
St. Helena-Beisa	454,792	353,294	--	--	--
Vaal Reefs	1,877,421	1,962,977	1,881,828	1,930,044	1,676,817
West Driefontein	174,566	159,638	86,705	81,435	72,971
Western Areas	282,465	305,403	311,836	265,211	205,112
Western Deep Levels	173,841	145,632	54,036	--	--
Miscellaneous	541,190	489,646	268,421	319,745	522,512
Total	7,127,992	6,761,608	5,751,254	5,460,269	4,735,030

[P]Preliminary.

[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. Ltd. in the Orange Free State Province.

Sources: Chamber of Mines of South Africa. Quarterly Analysis of Working Results, Oct.-Dec. 1983-87; Department of Mineral and Energy Affairs, Annual Reports 1983-86; East Rand Gold and Uranium Co. Ltd., Annual and Quarterly reports, 1983-87; Minerals Bureau, Mineral Production and Sales Statistics, 1985, 1986, and 1987; Palabora Mining Co. Ltd., Annual Reports 1983-87.

The Mineral Industry of Spain

By John G. Panulas[1]

Spain was the world's largest producer of slate in 1987. In addition, the country was a leading world producer of feldspar, fluorspar, kyanite, magnesite, natural sodium sulfate, and potash. Among the European Economic Community (EEC) members, Spain was the organization's largest producer of mined zinc, second largest producer of mined tin, third largest producer of mined lead, and eighth largest producer of mined copper and cadmium. Moreover, Spain continued as the EEC's sole producer of mercury, natural sodium sulfate, and tantalite.

PRODUCTION

The mineral industry in Spain operated in numerous regions throughout the country. The Government maintained a majority position in many of the mining enterprises. Among the prominent companies were Empresa Nacional del Aluminio S.A., which produced aluminum; Empresa Nacional Hulleras del Norte S.A., which produced bituminous coal; Rio Tinto Minera S.A. (RTM), which produced copper ore and refined copper; Sociedad Minera y Metallúrgica de Peñarroya de España (Peñarroya), which produced lead ore and primary lead; Minas de Almadén y Arrayanes S.A. (MAYASA), which produced mercury; Empresa Nacional Siderúrgica S.A. (ENSIDESA) and Altos Hornos de Vizcaya S.A. (AHV), which produced steel; and Asturiana de Zinc S.A., which produced zinc ore and primary zinc.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Bauxite	5,208	[r]7,273	2,427	[e]7,000	3,200
Alumina	737,000	741,569	724,700	[e]725,000	768,000
Metal:					
Primary	357,614	380,830	370,118	[e]354,400	341,000
Secondary	36,000	40,600	[e]38,000	[e]35,000	48,200
Antimony, mine output, Sb content	489	583	248	[e]200	200
Cadmium metal	278	290	268	247	300
Copper:					
Mine output, Cu content	49,964	63,105	55,486	51,084	15,000
Metal:					
Blister:					
Primary	100,000	97,000	88,000	[e]90,000	90,000
Secondary	18,000	30,000	40,000	[e]40,000	48,000
Total	118,000	127,000	128,000	[e]130,000	138,000
Refined:					
Primary	137,600	117,400	101,700	[e]113,200	98,800
Secondary	21,000	39,000	50,000	[e]45,000	52,000
Total	158,600	156,400	151,700	[e]158,200	150,800
Gold, mine output, Au content troy ounces	162,296	123,330	185,524	167,184	148,000
Iron and steel:					
Iron ore and concentrate (including byproduct concentrate):					
Gross weight thousand tons	7,449	7,961	6,463	6,054	6,100
Iron content do	3,512	3,558	2,926	2,761	2,800
Metal:					
Pig iron do	5,398	5,338	5,477	4,803	4,800
Ferroalloys, electric-furnace do	253	291	[e]300	[e]300	300
Steel:					
Crude do	12,731	13,484	14,235	11,977	11,900
Castings and forgings do	156	156	138	[e]150	140
Total do	12,887	13,640	14,373	12,127	13,040
Semimanufactures do	10,787	10,703	11,050	[e]11,000	11,000
Lead:					
Mine output, Pb content	82,453	96,638	85,636	82,057	84,400
Metal:					
Primary	107,800	110,088	112,800	88,000	77,000
Secondary	36,000	49,912	43,300	42,000	40,000
Mercury:					
Mine output, Hg content 76-pound flasks	43,250	22,680	25,333	79,987	40,000
Metal do	41,075	44,090	45,042	42,653	43,000
Silver, mine output, Ag content thousand troy ounces	1,496	4,999	9,482	9,298	5,710
Tantalum minerals (tin byproduct):					
Gross weight kilograms	47,000	31,950	18,300	12,500	10,000
Tantalum content do	15,066	9,739	4,496	3,071	2,500
Tin:					
Mine output, Sn content	444	438	637	296	400
Metal, primary	3,700	4,400	3,900	3,500	3,600
Titanium dioxide[e]	35,000	34,000	38,000	35,000	36,000
Tungsten, mine output, W content	517	565	458	495	350
Uranium, mine output, U_3O_8 content	283	366	308	376	300
Zinc:					
Mine output, Zn content	167,715	230,378	234,695	233,307	235,000
Metal, primary and secondary	189,900	207,400	213,300	213,600	208,800
INDUSTRIAL MINERALS					
Barite	52,410	68,919	67,512	49,678	67,000
Bromine[e]	330	300	350	280	300
Cement, hydraulic, other than natural thousand tons	30,632	25,435	24,197	24,201	23,400
Clays:					
Attapulgite	44,654	43,907	59,697	67,820	70,000
Bentonite	82,530	72,582	90,239	114,972	100,000
Kaolin, marketable:					
Crude	63,480	56,640	96,533	259,572	200,000
Washed	191,632	262,633	317,186	314,094	300,000
Refractory, not further described	453,952	516,166	449,226	549,457	550,000
Other thousand tons	10,262	9,006	9,598	9,244	10,000
Diatomite and tripoli	55,638	73,013	96,251	128,050	100,000
Feldspar	116,137	136,943	136,190	135,526	137,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Fluorspar:					
Gross weight:					
Acid-grade	190,749	253,221	266,774	257,108	260,000
Metallurgical-grade	41,585	42,445	38,835	25,352	25,000
Total	232,334	295,666	305,609	282,460	285,000
CaF_2 content:					
Acid-grade	190,749	246,121	258,561	250,374	250,000
Metallurgical-grade	41,585	33,710	31,140	22,404	25,000
Total	232,334	279,831	289,701	272,778	275,000
Gypsum and anhydrite, crude thousand tons	5,620	5,365	5,525	5,562	5,500
Kyanite and related materials	4,486	3,000	2,800	3,304	3,000
Lime, hydrated and quicklime[e] thousand tons	1,000	[2]1,088	1,100	1,200	1,200
Magnesite:					
Calcined	173,876	169,191	173,927	177,681	180,000
Crude	597,137	691,542	692,196	[e]700,000	710,000
Mica	1,300	990	727	325	250
Nitrogen: N content of ammonia thousand tons	506	670	600	[e]600	650
Pigments, mineral:					
Ocher	9,879	10,316	10,293	7,697	8,000
Red iron oxide[e]	20,000	20,000	21,000	20,000	20,000
Potash salts, K_2O equivalent	656,726	677,201	658,863	794,586	750,000
Pumice	1,002,301	829,827	849,440	968,116	950,000
Pyrite including cuprous, gross weight thousand tons	2,306	2,329	2,676	2,614	2,700
Salt:					
Rock including byproduct from potash works do	2,008	2,156	2,160	2,101	2,100
Marine and other do	1,149	1,233	1,079	1,006	1,000
Sand and gravel: Silica sand[3] do	2,100	2,267	2,467	2,403	2,400
Sepiolite	345,932	237,570	341,193	455,194	400,000
Sodium compounds, n.e.s.:					
Carbonate, manufactured[e] thousand tons	500	550	550	525	550
Sulfate:					
Natural:					
Glauberite, Na_2SO_4 content	130,566	214,198	243,745	288,714	290,000
Thenardite, Na_2SO_4 content	132,513	152,829	237,502	162,197	160,000
Manufactured[e]	170,000	170,000	150,000	150,000	160,000
Stone:					
Calcareous:					
Chalk thousand tons	377	362	412	427	430
Dolomite do	2,020	2,112	2,196	2,192	2,200
Limestone do	84,080	77,468	74,173	77,050	78,000
Marble do	685	623	798	955	1,000
Marl do	6,346	5,772	5,043	5,326	5,400
Basalt do	1,064	1,992	3,956	3,476	3,500
Granite do	7,527	7,853	9,127	10,843	10,800
Ofite do	1,044	1,212	1,225	1,050	1,000
Phonolite do	449	472	559	593	600
Porphyry do	461	475	795	715	700
Quartz do	502	372	252	568	600
Quartzite do	602	831	993	744	700
Sandstone do	1,365	1,599	2,274	2,620	2,700
Serpentine do	360	376	375	417	400
Other do	23,659	23,055	25,243	26,660	26,000
Strontium minerals:					
Gross weight	34,500	27,000	42,500	34,500	34,500
Sr_2O_4 content	31,740	24,840	39,100	31,740	31,740
Sulfur:					
S content of pyrites thousand tons	1,073	1,094	1,231	1,192	1,200
Byproduct:[e]					
Of metallurgy do	120	125	115	105	110
Of petroleum do	8	9	9	8	8
Of coal (lignite) gasification do	3	3	2	2	2
Total do	1,204	1,231	1,357	1,310	1,320
Talc and steatite	69,467	72,237	88,776	73,914	80,000
MINERAL FUELS AND RELATED MATERIALS					
Coal (marketable):					
Anthracite thousand tons	5,370	5,476	5,810	5,610	5,700
Bituminous do	10,049	9,814	10,281	10,286	10,000
Lignite do	24,524	24,303	23,572	22,425	22,000
Total do	39,943	39,593	39,663	38,321	37,700

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Coke, metallurgical ____ thousand tons	3,422	2,842	[e]3,000	[e]3,000	3,000
Gas, natural: Marketed ____ million cubic feet	183	6,245	9,626	13,554	11,000
Peat	39,622	55,561	54,049	63,869	62,000
Petroleum:					
Crude ____ thousand 42-gallon barrels	21,693	16,361	15,217	13,154	14,000
Refinery products:					
Liquefied petroleum gases ____ do	12,597	14,964	13,642	[e]13,500	13,500
Naphtha ____ do	18,606	23,709	24,973	[e]23,000	22,000
Gasoline, motor ____ do	47,787	52,350	57,019	[e]50,000	50,000
Jet fuel ____ do	16,968	18,160	19,312	[e]18,000	18,000
Kerosene ____ do	1,418	1,860	3,309	[e]2,500	2,000
Distillate fuel oil ____ do	74,771	78,067	85,887	[e]80,000	80,000
Residual fuel oil ____ do	108,391	108,238	94,719	[e]105,000	100,000
Other ____ do	45,927	28,420	46,267	[e]37,000	36,000
Refinery fuel and losses ____ do	10,405	1,112	5,582	[e]7,000	7,000
Total ____ do	336,870	326,880	350,710	[e]336,000	328,500

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through July 31, 1988.
[2]Reported figure.
[3]Includes sand obtained as a byproduct of feldspar and kaolin production.

TRADE

Spain incurred a trade deficit in 1987 of nearly $15 billion,[2] an increase of 150% over that of 1986. The deficit in nonenergy raw materials increased by about 50% over that of 1986, to $920 million. Of that amount, approximately 85% consisted of metalliferous ores and scrap. Nonferrous metals incurred a net outflow of $53 million, while iron and steel products enjoyed a trade surplus of about $479 million. In trade with the EEC, however, iron and steel products reflected a negative balance of $245 million.

Especially significant was that the EEC limited to 935,000 tons the volume of exports of iron and steel Spain could send to other EEC nations, excluding Portugal. Shipments to that country could not exceed 100,000 tons.

Table 2.—Spain: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	1	--		
Alkaline-earth metals	(2)	--		
Alumium:				
Ore and concentrate	807	1,120	--	Portugal 1,118; Tunisia 2.
Oxides and hydroxides	16,525	42,744	--	Italy 14,214; Finland 9,823; Sweden 9,623.
Ash and residue containing aluminum	--	137	--	France 115; Portugal 22.
Metal including alloys:				
Scrap	42	557	317	West Germany 112; Switzerland 51.
Unwrought	208,384	146,388	6,501	Netherlands 91,118; Italy 14,731; Japan 7,830.
Semimanufactures	32,080	32,124	1,688	France 8,570; Portugal 3,378; Republic of Korea 2,776.
Antimony:				
Ore and concentrate	--	1	--	All to Portugal.
Oxides	5	8	--	All to Italy.
Metal including alloys, all forms	240	43	--	Netherlands 27; France 16.
Arsenic: Metal including alloys, all forms	(2)	NA		
Bismuth: Metal including alloys, all forms	(2)	--		

See footnotes at end of table.

Table 2.—Spain: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Cadmium: Metal including alloys, all forms	209	230	20	Netherlands 210.
Chromium:				
Ore and concentrate	--	24	--	All to West Germany.
Oxides and hydroxides	225	109	--	Switzerland 46; Republic of South Africa 34; France 20.
Metal including alloys, all forms	(2)	2	--	All to France.
Cobalt:				
Oxides and hydroxides	27	1	--	All to Tunisia.
Metal including alloys, all forms	104	63	--	West Germany 45; Netherlands 10; Italy 8.
Columbium and tantalum:				
Ash and residue containing columbium and/or tantalum	508	--		
Metal including alloys, all forms, tantalum	4	3	(2)	Mainly to West Germany.
Copper:				
Ore and concentrate	74,975	59,397	--	Canada 23,299; Finland 19,126; Japan 7,438.
Matte and speiss including cement copper	1,959	3,134	--	Belgium-Luxembourg 1,874; West Germany 1,256; United Kingdom 4.
Oxides and hydroxides	(2)	18	18	
Sulfate	996	1,503	18	France 919; West Germany 439; Malaysia 40.
Ash and residue containing copper	--	1,465	--	United Kingdom 1,366; United Arab Emirates 98.
Metal including alloys:				
Scrap	569	607	--	Sweden 279; West Germany 98; Netherlands 94.
Unwrought	72,503	66,464	(2)	United Kingdom 17,083; Netherlands 15,650; Italy 13,047.
Semimanufactures	15,955	12,288	116	United Kingdom 2,736; Portugal 2,612; Italy 870.
Gold:				
Waste and sweepings value, thousands	--	$2	--	All to France.
Metal including alloys, unwrought and partly wrought do.	$65,299	$9,068	--	Switzerland $7,208; United Kingdom $1,112; Cuba $354.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	1,879	1,791	--	Netherlands 594; France 508; United Kingdom 403.
Pyrite, roasted do.	4	5	--	France 2; Gabon 1; United Kingdom 1.
Metal:				
Scrap	1,251	1,350	7	West Germany 692; Belgium-Luxembourg 453; Sweden 81.
Pig iron, cast iron, related materials	46,529	47,115	3	Italy 6,358; Denmark 5,663; Nigeria 4,919.
Ferroalloys:				
Ferrochromium	15,939	9,909	--	United Kingdom 2,925; West Germany 2,601; France 1,476.
Ferromanganese	26,781	22,084	3,562	Italy 3,846; West Germany 3,391.
Ferromolybdenum	2,079	2,389	--	Netherlands 1,844; Sweden 273; Republic of South Africa 126.
Ferrosilicomanganese	7,074	7,077	2,857	Italy 953; Japan 882.
Ferrosilicon	5,980	3,620	--	West Germany 2,092; United Kingdom 636; Netherlands 500.
Silicon metal	7,247	3,273	211	Japan 2,704; Sweden 273.
Unspecified	1,520	3,951	1,183	Netherlands 2,064; Sweden 273.
Steel, primary forms thousand tons	1,154	609	50	India 96; Morocco 91; Turkey 72.
Semimanufactures:				
Bars, rods, angles, shapes, sections do.	4,279	2,762	235	China 600; West Germany 218.
Universals, plates, sheets do.	1,181	1,288	224	U.S.S.R. 184; West Germany 71.
Hoop and strip do.	39	65	6	Syria 17; U.S.S.R. 7; France 2.
Rails and accessories do.	(2)	2	--	Venezuela 1.
Wire do.	45	70	1	Portugal 11; Libya 10; China 8.
Tubes, pipes, fittings do.	614	423	40	U.S.S.R. 67; West Germany 39.
Castings and forgings, rough do.	15	17	2	Italy 4; France 2; West Germany 2.

See footnotes at end of table.

Table 2.—Spain: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Lead:				
Ore and concentrate	40,769	42,215	--	United Kingdom 11,704; U.S.S.R. 9,869; Belgium-Luxembourg 9,555.
Oxides	753	499	--	Morocco 184; Portugal 154; Australia 126.
Ash and residue containing lead	25,546	29,606	--	Portugal 21,330; Belgium-Luxembourg 7,022; France 1,220.
Metal including alloys:				
Scrap	14	122	--	Italy 95; Portugal 25; United Kingdom 2.
Unwrought	56,016	22,502	--	Italy 9,726; Turkey 5,672; Yugoslavia 3,000.
Semimanufactures	121	207	--	West Germany 125; Italy 31; Portugal 24.
Lithium: Oxides and hydroxides	(2)	1	--	All to France.
Magnesium: Metal including alloys:				
Scrap	--	14	--	Do.
Unwrought	--	648	--	France 627; Netherlands 21.
Semimanufactures	40	34	--	France 31; Cuba 2.
Manganese:				
Oxides	2,204	2,231	--	Iraq 1,360; Nigeria 500; Czechoslovakia 240.
Metal including alloys, all forms	1	2	--	All to Cuba.
Mercury 76-pound flask	27,318	31,610	5,858	United Kingdom 5,858; Argentina 4,930.
Molybdenum: Metal including alloys:				
Scrap	(2)	--		
Semimanufactures	1	(2)	--	Mainly to Portugal.
Nickel:				
Matte and speiss	(2)	--		
Oxides and hydroxides	10	2	--	All to Denmark.
Ash and residue containing nickel	139	86	--	France 22; United Kingdom 22; Netherlands 21.
Metal including alloys:				
Scrap	164	97	--	West Germany 80; France 16.
Unwrought	--	13	--	Algeria 8; United Kingdom 5.
Semimanufactures	9	104	9	Mauritania 67; West Germany 12; Italy 10.
Platinum-group metals:				
Waste and sweepings value, thousands	--	$419	--	All to France.
Metals including alloys, unwrought and partly wrought do.	$2,689	$1,621	--	France $717; West Germany $411; Argentina $327.
Rare-earth metals including alloys, all forms	--	3	--	Republic of South Africa 1; Switzerland 1.
Silicon, high-purity	(2)	1	--	Mainly to Cuba.
Silver:				
Ore and concentrate[3] value, thousands	--	$38	--	All to Belgium-Luxembourg.
Waste and sweepings do.	--	$1,896	$1	United Kingdom $1,834; France $61.
Metal including alloys, unwrought and partly wrought do.	$29,062	$9,825	$42	United Kingdom $5,274; Switzerland $1,555; Netherlands $1,084.
Tin:				
Ore and concentrate	5	--		
Oxides	12	(2)	--	All to Morocco.
Ash and residue containing tin	339	--		
Metal including alloys:				
Scrap	56	--		
Unwrought	203	226	--	Netherlands 130; France 43; Portugal 40.
Semimanufactures	49	278	--	Panama 269; Italy 5; Nicaragua 3.
Titanium:				
Ore and concentrate	(2)	125	--	Cuba 123; Portugal 2.
Oxides	10,815	1,904	889	Canada 306; Japan 256.
Metal including alloys:				
Scrap	6	31	--	France 22; West Germany 8; Switzerland 1.
Unwrought	1	17	--	All to United Kingdom 17.
Semimanufactures	13	23	(2)	Italy 17; France 2; West Germany 2.

See footnotes at end of table.

Table 2.—Spain: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Tungsten:				
Ore and concentrate	714	744	--	West Germany 495; Sweden 115; United Kingdom 84.
Metal including alloys:				
Scrap	(2)	1	--	Mainly to West Germany.
Unwrought	(2)	--		
Semimanufactures	3	(2)	--	Mainly to Cuba.
Uranium and/or thorium: Ore and concentrate	--	108	--	France 98; Mexico 10.
Vanadium:				
Oxides and hydroxides	--	15	--	All to Andorra.
Ash and residue containing vanadium	--	46	46	
Zinc:				
Ore and concentrate	119,509	126,443	--	Italy 52,114; Finland 25,888; France 13,128.
Oxides	2,029	2,197	--	West Germany 685; Belgium-Luxembourg 456; France 341.
Blue powder	829	598	--	U.S.S.R. 596; West Germany 1; Mexico 1.
Matte	144	196	--	Netherlands 100; Portugal 72; France 24.
Ash and residue containing zinc	10,147	2,387	--	West Germany 1,194; Belgium-Luxembourg 613; France 396.
Metal including alloys:				
Scrap	--	1	--	Mainly to Costa Rica.
Unwrought	127,214	94,199	25,473	Netherlands 42,776; China 4,577.
Semimanufactures	203	276	--	Mexico 175; France 46.
Zirconium:				
Ore and concentrate	300	110	--	Portugal 74; Mexico 26.
Metal including alloys, scrap	24	--		
Other:				
Ores and concentrates	3	24	--	All to Portugal.
Oxides and hydroxides	40	262	21	United Kingdom 74; Portugal 31; Hong Kong 30.
Ashes and residues	412	731	--	Belgium-Luxembourg 299; United Kingdom 246; Philippines 132.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	1,747	2,085	(2)	West Germany 982; Portugal 272; France 236.
Artificial:				
Corundum	709	2,251	95	West Germany 1,406; United Kingdom 391; Portugal 125.
Silicon carbide	4,649	3,618	56	United Kingdom 1,382; France 874; West Germany 441.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$105	$30	$6	Mexico $10; Ireland $6.
Grinding and polishing wheels and stones	3,337	3,117	512	France 443; West Germany 309.
Asbestos, crude	189	194	--	Portugal 181; Morocco 13.
Barite and witherite	58,957	41,892	--	Italy 14,868; West Germany 11,748; Angola 7,621.
Boron materials:				
Crude natural borates	1,311	637	--	Portugal 586; West Germany 46; Netherlands 5.
Elemental	(2)	--		
Oxides and acids	9	2	--	France 1.
Cement thousand tons	7,980	5,578	2,734	Algeria 455; Ivory Coast 445.
Chalk	2,669	2,969	--	Libya 1,500; Portugal 1,048; Morocco 258.
Clays, crude:				
Bentonite	29,045	33,258	--	Netherlands 12,594; Portugal 11,459; Libya 3,299.
Chamotte earth	350	1,493	--	West Germany 938; Morocco 200; Italy 96.
Fuller's earth	2,817	3,337	--	Netherlands 1,217; Egypt 1,094; Italy 603.
Kaolin	109,218	127,842	--	Italy 41,854; West Germany 21,269; Finland 18,324.
Unspecified	50,150	72,702	--	Netherlands 53,757; France 5,587; Portugal 3,226.

See footnotes at end of table.

Table 2.—Spain: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Cryolite and chiolite	--	1	--	All to Portugal.
Diamond:				
Gem, not set or strung value, thousands	$3,532	$236	--	Belgium-Luxembourg $96; Panama $61; France $60.
Industrial stones do	$1,036	$57	$12	Sweden $24; Ireland $6.
Diatomite and other infusorial earth	3,250	4,087	--	Belgium-Luxembourg 2,473; West Germany 366; France 310.
Feldspar, fluorspar, related materials:				
Feldspar	4,739	2,578	--	France 2,458; Morocco 120.
Fluorspar	148,978	171,600	29,203	Italy 31,707; Canada 28,037.
Unspecified	--	5	--	All to Tunisia.
Fertilizer materials:				
Crude, n.e.s	538	838	--	Andorra 340; France 224; Saudi Arabia 189.
Manufactured:				
Ammonia	40	(2)	NA	NA.
Nitrogenous	301,698	162,833	--	West Germany 81,310; France 25,446; Belgium-Luxembourg 25,295.
Phosphatic	1,488	1,017	--	Ireland 1,000; Andorra 17.
Potassic	562,261	488,900	--	France 106,847; Italy 76,810; Brazil 64,300.
Unspecified and mixed	136,216	133,212	--	Venezuela 42,525; China 25,006; Algeria 23,135.
Graphite, natural	42	126	--	Italy 98; France 22; United Kingdom 4.
Gypsum and plaster thousand tons	2,193	2,486	1,175	Denmark 186; Sweden 151.
Iodine	1	6	--	Switzerland 4; Cuba 1; Turkey 1.
Kyanite and related materials	50	49	--	Italy 48.
Lime	9,051	6,329	--	France 2,495; Equatorial Guinea 2,132; Cameroon 1,053.
Magnesium compounds:				
Magnesite, crude	620	8	--	All to Saudi Arabia.
Oxides and hydroxides	121,858	109,289	145	France 4,947; West Germany 1,416; unspecified 101,830.
Mica:				
Crude including splittings and waste	60	23	--	Cuba 21; Portugal 1.
Worked including agglomerated splittings	147	100	--	Italy 40; West Germany 21; Turkey 16.
Nitrates, crude	23	--		
Phosphates, crude	24	404	--	United Kingdom 402; Andorra 2.
Phosphorus, elemental	(2)	9	--	All to Portugal.
Pigments, mineral:				
Natural, crude	--	34	--	Italy 24; Andorra 10.
Iron oxides and hydroxides, processed	10,120	9,881	723	United Kingdom 1,196; Algeria 800.
Potassium salts, crude	--	5,650	--	All to Portugal.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$176	$151	$6	Andorra $30; United Arab Emirates $29; Panama $28.
Synthetic do	$216	$460	$24	Switzerland $367; France $16.
Pyrite, unroasted	312,087	347,216	--	Belgium-Luxembourg 190,080; Turkey 90,678; Yugoslavia 27,906.
Salt and brine	893,973	511,152	128,236	Norway 57,214; Iceland 56,990.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	114,197	137,821	701	Republic of South Africa 56,763; Belgium-Luxembourg 20,183; Argentina 18,098.
Sulfate, manufactured	140,947	NA		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	435,962	376,204	271	Italy 279,081; United Kingdom 58,068; France 12,091.
Worked	305,488	316,966	37,515	France 163,925; West Germany 47,559; United Kingdom 19,110.
Dolomite, chiefly refractory-grade	121,470	184,497	50,000	United Kingdom 128,923; Saudi Arabia 2,200.
Gravel and crushed rock	33,686	47,087	100	United Kingdom 34,127; Morocco 9,450; Andorra 1,292.
Quartz and quarzite	390,562	374,982	--	Norway 224,816; Italy 33,606; France 33,530.
Sand other than metal-bearing	182,879	269,363	--	Andorra 235,297; United Kingdom 20,296; Portugal 8,147.

See footnotes at end of table.

Table 2.—Spain: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur:				
Elemental:				
Crude including native and by-product	145	425	--	France 341; Morocco 52; Portugal 32.
Colloidal, precipitated, sublimed	34	76	--	All to France.
Dioxide	168	55	--	All to Portugal.
Sulfuric acid	182,661	482,245	63,609	Brazil 185,389; Belgium-Luxembourg 53,849.
Talc, steatite, soapstone, pyrophyllite	31,197	32,911	--	Belgium-Luxembourg 20,399; United Kingdom 4,835; Italy 3,206.
Vermiculite, perlite, chlorite	407	608	--	West Germany 403; Algeria 150; Austria 24.
Other:				
Crude	770,541	748,605	1,804	Belgium-Luxembourg 293,879; France 169,074; West Germany 88,609.
Slag and dross, not metal-bearing	205,195	115,878	2,025	France 67,627; Portugal 42,540.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	199	1,553	--	Portugal 1,282; Andorra 184; United Kingdom 79.
Carbon:				
Carbon black	17,857	16,420	--	France 8,813; West Germany 5,406; Italy 1,048.
Gas carbon	4,583	6,965	213	Morocco 3,544; Israel 2,110.
Coal:				
Anthracite	4,974	28	--	Portugal 25; Cameroon 3.
Bituminous	1	37	--	Italy 23; Andorra 12.
Briquets of anthracite and bituminous coal	(2)	1	--	All to West Germany.
Coke and semicoke	11,107	26,733	--	Sweden 8,556; West Germany 7,545; Portugal 4,990.
Peat including briquets and litter	229	56	--	All to Portugal.
Petroleum refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	1,077	2,075	--	Morocco 917; Netherlands 539; Senegal 186.
Gasoline do	17,409	26,092	9,713	Netherlands 4,897; France 3,491.
Mineral jelly and wax do	90	96	(2)	West Germany 46; Netherlands 21; Portugal 8.
Kerosene and jet fuel do	5,701	12,030	1,978	Netherlands 4,644; Nigeria 1,538.
Distillate fuel oil do	5,709	8,218	1,069	Netherlands 1,733; Mauritania 985; bunkers 1,288.
Lubricants do	2,560	3,284	128	France 1,682; Italy 617; India 159.
Residual fuel oil do	41,699	53,683	3,927	Netherlands 15,100; United Kingdom 5,192; France 4,876.
Bitumen and other residues do	4,112	2,471	46	Algeria 492; Italy 318; France 259.
Bituminous mixtures do	412	753	546	Portugal 98; Libya 52.
Petroleum coke do	13	35	--	U.S.S.R. 17; Italy 16; Portugal 1.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	86	90	--	West Germany 53; France 17; Italy 16.
Alkaline-earth metals	68	48	1	France 20; Canada 17; U.S.S.R. 10.
Aluminum:				
Ore and concentrate thousand tons	1,589	1,431	--	Guinea 1,353; Guyana 29; China 27.
Oxides and hydroxides	25,235	22,302	239	France 11,000; West Germany 6,353; United Kingdom 3,379.
Ash and residue containing aluminum	11,668	17,028	306	West Germany 4,651; Austria 3,408; Italy 2,732.
Metal including alloys:				
Scrap	9,143	19,133	609	United Kingdom 7,757; France 6,282; Portugal 2,094.
Unwrought	10,656	21,814	1	Iceland 5,992; Romania 3,455; West Germany 3,149.
Semimanufactures	22,802	42,287	2,126	West Germany 9,236; Italy 6,235; France 5,307.
Antimony:				
Ore and concentrate	587	630	--	Thailand 353; Peru 162; Morocco 98.
Oxides	200	273	(2)	France 97; United Kingdom 61; Belgium-Luxembourg 59.
Metal including alloys, all forms	41	178	--	China 70; Thailand 39; United Kingdom 23.
Arsenic:				
Oxides and acids	118	182	--	France 110; Belgium-Luxembourg 72.
Metal including alloys, all forms	13	NA		
Beryllium: Metal including alloys, all forms	(2)	--		
Bismuth:				
Oxides and hydroxides	35	--		
Metal including alloys, all forms	59	83	(2)	Belgium-Luxembourg 34; United Kingdom 31; Mexico 7.
Cadmium: Metal including alloys, all forms	49	92	--	West Germany 53; Belgium-Luxembourg 38; Yugoslavia 1.
Chromium:				
Ore and concentrate	79,042	92,194	--	Albania 43,419; Republic of South Africa 27,173; Turkey 16,000.
Oxides and hydroxides	298	349	1	West Germany 267; China 40; United Kingdom 23.
Metal including alloys, all forms	29	40	1	West Germany 22; West Germany 15; Sweden 2.
Cobalt:				
Ore and concentrate	(2)	(2)	--	All from West Germany.
Oxides and hydroxides	97	113	10	Belgium-Luxembourg 51; Canada 21; Finland 15.
Metal including alloys, all forms	131	197	2	West Germany 53; Zaire 50; Finland 43.
Columbium and tantalum: Metal including alloys, all forms:				
Columbium (niobium)	1	(2)	--	Mainly from West Germany.
Tantalum	5	18	9	Netherlands 9.
Copper:				
Ore and concentrate	125,318	249,641	--	Papua New Guinea 80,631; Mexico 55,617; Morocco 54,640.
Matte and speiss including cement copper	3,126	2,217	--	France 612; Italy 503; Portugal 348.
Oxides and hydroxides	542	527	(2)	West Germany 214; Norway 131; Italy 118.
Sulfate	164	1,081	--	France 777; Portugal 253; Hungary 23.
Ash and residue containing copper	42,047	44,342	7,988	Brazil 26,680; Cuba 1,505.
Metal including alloys:				
Scrap	31,112	29,984	7,184	France 10,342; United Kingdom 2,540.
Unwrought	51,325	51,759	15	Chile 30,076; Belgium-Luxembourg 12,281; Iran 2,494.
Semimanufactures	36,379	63,239	352	France 15,387; Italy 14,267; Netherlands 9,002.
Germanium: Metal including alloys, all forms	(2)	(2)	(2)	
Gold:				
Waste and sweepings value, thousands	$148,330	$26,912	--	Switzerland $23,435; France $2,718; Netherlands $330.
Metal including alloys, unwrought and partly wrought do.	$15,644	$35,090	$341	Switzerland $14,748; Sweden $4,397; France $3,977.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	5,023	4,287	(2)	Brazil 2,266; Australia 737; Venezuela 491.
Pyrite, roasted do	--	120	--	All from Belgium-Luxembourg.
Metal:				
Scrap do	6,146	4,342	648	United Kingdom 1,750; France 932.
Pig iron, cast iron, related materials	177,624	206,523	115	Brazil 70,944; Malaysia 32,234; Republic of South Africa 23,653.
Ferroalloys:				
Ferrochromium	46,615	71,373	23	Republic of South Africa 46,290; Finland 13,483; Zimbabwe 3,392.
Ferromanganese	1,260	6,636	--	Republic of South Africa 4,336; France 2,152; West Germany 123.
Ferromolybdenum	162	109	--	Belgium-Luxembourg 50; United Kingdom 39; Austria 15.
Ferronickel	7,908	24,851	--	Dominican Republic 6,999; France 6,382; New Caledonia 5,258.
Ferrosilicochromium	1,691	1,620	--	Zimbabwe 1,571; Yugoslavia 25; France 23.
Ferrosilicomanganese	1,516	1,393	--	Republic of South Africa 8,142; Portugal 3,000; Yugoslavia 250.
Ferrosilicon	5,299	11,998	--	Norway 4,195; Yugoslavia 2,698; France 2,470.
Silicon metal	65	17	--	West Germany 7; Netherlands 6; Norway 3.
Unspecified	3,479	10,841	384	France 8,763; West Germany 1,204; Italy 175.
Steel, primary forms	669,407	1,286,895	13,423	West Germany 328,451; France 324,606; Netherlands 208,022.
Semimanufactures:				
Bars, rods, angles, shapes, sections	145,391	226,772	209	West Germany 67,358; France 44,668; United Kingdom 35,394.
Universals, plates, sheets	469,283	864,578	1,518	West Germany 273,004; France 149,432; Belgium-Luxembourg 98,298.
Hoop and strip	81,564	128,182	85	West Germany 66,995; France 21,587; Italy 10,957.
Rails and accessories	1,484	3,439	--	Belgium-Luxembourg 1,537; United Kingdom 527; Austria 476.
Wire	12,152	23,345	79	Belgium-Luxembourg 9,593; France 4,447; Netherlands 2,339.
Tubes, pipes, fittings	41,429	90,841	3,617	France 34,334; West Germany 18,527; Italy 12,972.
Castings and forgings, rough	1,711	2,487	78	Italy 1,492; France 510; West Germany 207.
Lead:				
Ore and concentrate	66,862	50,320	--	Canada 14,824; Republic of South Africa 14,186; Italy 5,547.
Oxides	20	33	--	West Germany 27; United Kingdom 6.
Ash and residue containing lead	16,041	7,493	14	Belgium-Luxembourg 2,575; Italy 2,350; Canada 1,601.
Metal including alloys:				
Scrap	784	44	15	United Kingdom 16; France 5.
Unwrought	3,663	8,902	--	Morocco 4,164; France 3,336; Netherlands 336.
Semimanufactures	174	149	51	France 34; West Germany 28; Italy 19.
Lithium:				
Oxides and hydroxides	140	95	59	Yugoslavia 20; U.S.S.R. 10.
Metal including alloys, all forms	(2)	(2)	--	Mainly from United Kingdom.
Magnesium: Metal including alloys:				
Scrap	7	4	--	All from France.
Unwrought	1,505	2,390	1,477	Norway 526; France 254.
Semimanufactures	66	31	3	West Germany 16; Belgium-Luxembourg 9.
Manganese:				
Ore and concentrate, metallurgical-grade	299,032	244,300	--	Gabon 64,450; Ghana 33,115; Australia 17,786.
Oxides	757	1,471	4	Belgium-Luxembourg 553; Ireland 260; Greece 256.
Metal including alloys, all forms	466	676	184	United Kingdom 240; France 188.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Mercury ——— 76-pound flasks	31	551	NA	Netherlands 261; China 145; U.S.S.R. 87.
Molybdenum:				
Ore and concentrate	4,600	5,236	578	Chile 3,375; United Kingdom 898.
Oxides and hydroxides	(2)	2	--	All from Belgium-Luxembourg.
Metal including alloys:				
Scrap	--	2	--	All from West Germany.
Unwrought	1	3	2	United Kingdom 1.
Semimanufactures	24	27	1	Austria 9; West Germany 5.
Nickel:				
Matte and speiss	1,849	1,591	46	Canada 836; Norway 229; Australia 221.
Oxides and hydroxides	24	16	--	Canada 13; Belgium-Luxembourg 3.
Ash and residue containing nickel	121	209	58	France 89; West Germany 67.
Metal including alloys:				
Scrap	8	15	--	France 10; Republic of South Africa 2; United Kingdom 1.
Unwrought	3,780	4,864	3	Canada 1,554; U.S.S.R. 1,546; Zimbabwe 567.
Semimanufactures	1,118	865	17	West Germany 395; Sweden 97; United Kingdom 87.
Platinum-group metals:				
Waste and sweepings value, thousands	$7,342	$5,054	$469	United Kingdom $1,198; Costa Rica $875; Mexico $694.
Metals including alloys, unwrought and partly wrought ——do	$3,127	$9,718	$43	United Kingdom $3,739; Republic of South Africa $1,766; France $1,647.
Rare-earth metals including alloys, all forms	11	43	6	United Kingdom 26; Brazil 6.
Rhenium: Metal including alloys, all forms	1	(2)	(2)	Mainly from Netherlands.
Selenium, elemental	46	83	--	United Kingdom 35; Canada 22; Switzerland 11.
Silicon, high-purity	23	1	1	
Silver:				
Ore and concentrate[3] value, thousands	$18,901	$31,864	$312	Papua New Guinea $24,759; Mexico $2,614; Republic of South Africa $1,804.
Waste and sweepings ——do	$34,045	$2,439	--	Panama $1,194; Switzerland $578; Peru $546.
Metal including alloys, unwrought and partly wrought ——do	$4,217	$43,680	$1,119	United Kingdom $8,308; Sweden $7,269; France $5,686.
Tellurium, elemental	3	NA		
Tellurium, elemental and arsenic	--	16	(2)	Sweden 10; China 3; Peru 2.
Tin:				
Ore and concentrate	4,262	3,071	--	China 1,088; Zaire 1,014; Thailand 366.
Oxides	209	249	--	United Kingdom 177; Italy 45; West Germany 27.
Ash and residue containing tin	11	--		
Metal including alloys:				
Scrap	(2)	--		
Unwrought	253	1,576	--	United Kingdom 923; Netherlands 409; West Germany 122.
Semimanufactures	116	167	1	United Kingdom 69; West Germany 46; Portugal 30.
Titanium:				
Ore and concentrate	188,617	106,920	--	Australia 84,160; Malaysia 19,068; Republic of South Africa 2,623.
Oxides	1,073	1,336	1	West Germany 310; France 283; Belgium-Luxembourg 235.
Metal including alloys:				
Scrap	497	322	101	France 221.
Unwrought	322	368	198	United Kingdom 72; Austria 70.
Semimanufactures	309	1,018	164	United Kingdom 336; France 212; West Germany 194.
Tungsten:				
Oxides and hydroxides	--	1	--	All from West Germany.
Metal including alloys:				
Scrap	1	9	--	West Germany 8; France 1.
Unwrought	4	5	1	France 3; West Germany 1.
Semimanufactures	473	75	--	West Germany 15; Austria 7; unspecified 42.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Uranium and/or thorium:				
Ore and concentrate	27	47	--	Morocco 24; Austria 23.
Metal including alloys, all forms:				
Uranium	(2)	(2)	--	All from West Germany.
Thorium	--	(2)	--	All from United Kingdom.
Vanadium:				
Oxides and hydroxides	145	117	(2)	Republic of South Africa 70; Netherlands 24; China 23.
Metal including alloys, unwrought	--	(2)	--	All from West Germany.
Zinc:				
Ore and concentrate	34,950	34,615	--	Ireland 16,111; Peru 9,914; Canada 5,377.
Oxides	412	706	--	Portugal 319; West Germany 310; France 41.
Blue powder	77	176	1	West Germany 166; Belgium-Luxembourg 8.
Matte	3,018	3,127	184	France 1,352; West Germany 600; Algeria 355.
Ash and residue containing zinc	2,294	6,131	40	West Germany 2,892; France 1,850; Italy 903.
Metal including alloys:				
Scrap	252	1,326	--	France 1,116; United Kingdom 84; Belgium-Luxembourg 80.
Unwrought	1,730	7,174	--	Belgium-Luxembourg 3,144; France 1,930; Netherlands 1,277.
Semimanufactures	727	730	--	West Germany 334; Belgium-Luxembourg 279; United Kingdom 50.
Zirconium:				
Ore and concentrate	37,210	25,813	5	Republic of South Africa 14,738; Australia 11,004; United Kingdom 40.
Metal including alloys:				
Unwrought	(2)	(2)	--	All from West Germany.
Semimanufactures	1	1	(2)	Mainly from France.
Other:				
Ores and concentrates	(2)	4	--	Australia 3; Morocco 1.
Oxides and hydroxides	98	207	(2)	France 83; Belgium-Luxembourg 63; United Kingdom 35.
Ashes and residues	6,461	6,312	17	Italy 4,395; West Germany 1,529; Australia 235.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural; Corundum, emery, pumice, etc	1,763	2,890	10	Greece 1,341; Italy 1,044; France 253.
Artificial:				
Corundum	5,589	5,742	59	Austria 1,448; France 1,424; West Germany 1,350.
Silicon carbide	2,450	2,620	(2)	West Germany 1,100; Norway 533; Italy 335.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$4,111	$4,904	$815	Ireland $3,704; West Germany $140.
Grinding and polishing wheels and stones	1,546	3,831	14	West Germany 1,277; France 1,009; Italy 946.
Asbestos, crude	38,022	43,874	146	Canada 19,764; Zimbabwe 15,577; Italy 4,005.
Barite and witherite	261	1,238	--	Sweden 920; France 203; Morocco 96.
Boron materials:				
Crude natural borates	78,288	99,510	36,297	Turkey 63,175; United Kingdom 21.
Elemental	(2)	(2)	(2)	
Oxides and acids	390	443	--	Italy 257; France 144; Belgium-Luxembourg 22.
Bromine	165	45	--	Israel 37; France 8.
Cement	5,443	76,115	4	Tunisia 61,003; Morocco 4,309; France 3,165.
Chalk	9,818	12,788	--	France 12,541; West Germany 169; Belgium-Luxembourg 67.
Clays, crude:				
Bentonite	31,913	27,361	1,891	Morocco 18,919; Greece 3,730.
Chamotte earth	6,394	5,951	1,873	France 3,954; West Germany 106.
Fuller's earth	19	2,978	113	West Germany 1,298; Belgium-Luxembourg 1,077.
Kaolin	188,449	177,730	15,130	United Kingdom 139,496; France 17,728; West Germany 4,374.
Unspecified	22,946	21,481	116	United Kingdom 11,916; France 8,021; West Germany 847.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Cryolite and chiolite	75	690	--	Denmark 680; France 10.
Diamond:				
Gem, not set or strung value, thousands	$25,736	$6,283	--	Belgium-Luxembourg $5,235; Netherlands $458; Israel $319.
Industrial stones ---do---	$1,823	$1,382	$8	Zaire $525; Belgium-Luxembourg $243; Ghana $193.
Diatomite and other infusorial earth	2,742	3,355	1,013	France 1,934; Iceland 245.
Feldspar, fluorspar, related materials:				
Feldspar	18,403	19,830	--	France 18,373; West Germany 655; Portugal 260.
Fluorspar	158	44	--	France 43; West Germany 1.
Unspecified	1,672	2,416	--	Canada 1,512; Norway 855; France 45.
Fertilizer materials:				
Crude, n.e.s	851	1,568	34	Netherlands 1,030; France 254; Italy 210.
Manufactured:				
Ammonia	705,395	782,114	78,340	U.S.S.R. 263,557; Libya 63,103.
Nitrogenous	106,315	599,926	(2)	Italy 113,947; Netherlands 99,687; Libya 88,793.
Phosphatic	8,867	55,624	13,941	Israel 20,307; Tunisia 11,669.
Potassic	1,790	12,643	37	Israel 8,747; United Kingdom 1,553; Jordan 1,500.
Unspecified and mixed	49,858	291,056	78,184	West Germany 52,989; Morocco 33,998.
Graphite, natural	2,519	3,993	--	Mexico 999; China 910; West Germany 895.
Gypsum and plaster	19,056	30,985	33	Morocco 30,289; United Kingdom 427; France 150.
Iodine	215	228	--	Japan 27; Chile 1; unspecified 200.
Kyanite and related materials	3,327	5,284	451	Republic of South Africa 3,400; France 814.
Lime	330	404	--	West Germany 310; France 62; Japan 18.
Magnesium compounds:				
Magnesite, crude	26	5	--	United Kingdom 4; Austria 1.
Oxides and hydroxides	66,982	62,480	151	Greece 21,185; Italy 12,804; North Korea 6,605.
Other	272	264	--	All from France.
Mica:				
Crude including splittings and waste	4,002	2,602	3	Zimbabwe 657; India 461; Sweden 460.
Worked including agglomerated splittings	142	528	73	West Germany 319; France 56; Belgium-Luxembourg 36.
Nitrates, crude	24,056	25,050	--	All from Chile.
Phosphates, crude --- thousand tons	2,775	3,701	--	Morocco 3,116; Senegal 210; Togo 91.
Phosphorus, elemental	225	302	28	Canada 172; West Germany 39; U.S.S.R. 34.
Pigments, mineral:				
Natural, crude	314	231	--	West Germany 141; United Kingdom 36; France 29.
Iron oxides and hydroxides, processed	5,896	6,237	7	West Germany 4,814; France 656; Italy 435.
Precious and semiprecious stones other than diamond:				
Natural ----- value, thousands	$5,832	$3,740	$9	Thailand $1,645; India $508; West Germany $402.
Synthetic ---do---	$5,193	$5,958	$696	Ireland $1,236; Switzerland $1,195; Repbublic of Korea $1,134.
Pyrite, unroasted	356	253	--	France 141; Italy 112.
Salt and brine ------ thousand tons	619	5,155	4	Belgium-Luxembourg 4,001; United Kingdom 531; Netherlands 516.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	143	403	(2)	France 401; United Kingdom 1.
Sulfate, manufactured	386	NA		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked -----	147,945	164,181	320	Portugal 51,296; Italy 41,607; Finland 30,800.
Worked	7,736	14,570	21	Portugal 7,280; Italy 5,502; France 1,014.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel —Continued				
Dolomite, chiefly refractory-grade	9,865	12,263	--	France 6,152; Belgium-Luxembourg 5,563; Norway 248.
Gravel and crushed rock	46,082	60,484	--	Morocco 44,679; France 14,553; United Kingdom 756.
Quartz and quartzite	7,849	2,501	4	Sweden 1,115; West Germany 798; Belgium-Luxembourg 341.
Sand other than metal-bearing	55,143	40,472	94	France 24,941; Morocco 12,932; West Germany 1,094.
Sulfur:				
Elemental:				
Crude including native and by-product	71,254	43,079	--	France 41,650; West Germany 1,360; Portugal 68.
Colloidal, precipitated, sublimes	60	37	(2)	West Germany 26; France 11.
Dioxide	23	3	--	Turkey 2; Belgium-Luxembourg 1.
Sulfuric acid	6,147	35,744	--	Italy 15,615; United Kingdom 12,885; France 6,083.
Talc, steatite, soapstone, pyrophyllite	11,682	13,662	197	France 9,201; Belgium-Luxembourg 1,363; Norway 1,352.
Vermiculite, perlite, chlorite	41,156	16,909	--	Turkey 7,930; U.S.S.R. 6,396; Republic of South Africa 2,427.
Other:				
Crude	20,073	21,823	1,077	Morocco 5,400; Norway 3,348; Italy 1,770.
Slag and dross, not metal-bearing	3,194	5,073	2,550	France 1,715; West Germany 665.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	514	702	578	United Kingdom 121; France 2.
Carbon:				
Carbon black	3,873	5,155	148	France 2,597; West Germany 1,106; Netherlands 1,069.
Gas carbon	17,608	17,597	263	France 14,014; Portugal 531; West Germany 495.
Coal:				
Anthracite thousand tons	6	28	--	All from Republic South Africa.
Bituminous do	8,412	8,687	2,220	Republic of South Africa 4,051; Australia 1,738.
Briquets of anthracite and bituminous coal do	(2)	(2)	--	All from Italy.
Lignite including briquets do	140	146	--	East Germany 144; France 2.
Coke and semicoke do	214	198	46	Poland 51; France 31.
Gas, natural:				
Gaseous million cubic feet	(2)	(2)	--	All from Italy.
Liquefied thousand tons	1,909	1,987	--	Algeria 1,123; Libya 837.
Peat including briquets and litter	50,000	49,090	--	West Germany 40,363; Netherlands 5,458; United Kingdom 1,678.
Petroleum:				
Crude thousand 42-gallon barrels	319,436	325,745	--	Mexico 64,025; Libya 48,596; Iraq 46,887.
Refinery products:				
Liquefied petroleum gas do	10,499	8,547	(2)	France 3,723; United Kingdom 1,404; Algeria 377.
Gasoline do	12,911	17,271	(2)	Libya 4,755; Italy 1,735; Iraq 1,592.
Mineral jelly and wax do	31	43	(2)	Portugal 10; Netherlands 9; United Kingdom 7.
Kerosene and jet fuel do	291	573	6	Italy 356; Portugal 157; Ivory Coast 43.
Distillate fuel oil do	8,484	11,472	3,737	U.S.S.R. 1,015; Italy 973.
Lubricants do	629	531	175	France 151; Belgium-Luxembourg 51.
Residual fuel oil do	13,170	12,536	1,225	Saudi Arabia 1,770; Netherlands 722; bunkers 2,100.
Bitumen and other residues do	85	59	(2)	France 43; Portugal 15.
Bituminous mixtures do	29	12	(2)	West Germany 3; United Kingdom 3; France 2.
Petroleum coke do	4,581	9,571	9,091	United Kingdom 418; West Germany 48.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

COMMODITY REVIEW

METALS

Aluminum.—Management at Aluminio Español S.A. (INESPAL), state-owned aluminum producer, curtailed operations at San Ciprian, the largest aluminum plant in Spain. Situated on the northwestern coast of the country, the facility incurred a 3-day wildcat strike by workers to protest the loading of toxic chemicals on the premises, despite an appeal by management to labor to stay on the job to maintain the potlines. Consequently, potline temperatures dropped below those levels at which aluminum could be recovered, and all 512 pots along with the 2 potlines were damaged. Reportedly, repairs to the 180,000-ton-per-year electrolytic production facility would require a $172 million expenditure and a 6-month completion time. To offset output losses, INESPAL began to import 6,000 tons per month of aluminum to meet contractual obligations. Costs of the damage were offset, in part, by the dismissal of more than 100 workers who failed to return to work in time to save the pots.

Copper.—In December 1987, RTM signed an agreement with various socialist trade unions and the Andalusian Government not to close the Huelva copper mines in southern Spain in 1988. Production was halted there earlier in 1987 as a result of the high cost of extracting copper from low-grade ores and RTM's consequent inability to repay $152 million in debt to its bankers.

RTM agreed to operate the Huelva facilities on a care-and-maintenance basis until yearend 1988. At that time, the company would reopen and run the mines at a low output, provided that the 3-month forward price for copper on the London Metal Exchange equaled or exceeded $793.18 per ton for a 3-month period. In addition, workers would continue to receive full salary in 1988, with those 55 years of age or older offered the option of early retirement.

However, in light of the drop in annual copper mine production from 61,000 tons in 1985 to 51,084 tons in 1986 and to approximately 15,000 tons in 1987, RTM was expected to shift the focus of its operations at Huelva from mining to smelting ore received from the Neves-Corvo copper mine in Portugal, in which RTM's parent company, RTZ Corp. PLC, has a 49% interest. RTM is itself owned 49% by RTZ and 51% by the Spanish Government.

In a move to reduce expenses, Centrimetal, a foundry near Bilbao in northern Spain, concluded a deal with Inductotherm Europe (Droitwich, United Kingdom) for an induction melting plant in late 1987. The plant was to consist of four Duraline tilting furnaces with a 500-kilogram capacity, powered by a 350-kilowatt, 100-hertz inverter. The new equipment could melt copper and copper alloys utilizing less time and energy than the oil-fired furnaces that the induction furnaces would replace.

Ferroalloys.—In March, Ferroaleaciones y Electrometales (Fyesa) reopened its Santander facility on the northern Spanish coast, after suspending operations for 3 months to restructure its sales and distribution activities. Although expected plant output at 50% of full capacity was to equal the 40,000 tons of silicomanganese and 30,000 tons of high carbon ferromanganese produced in 1985 and 1986 together, output was marketed only to domestic consumers in 1987. Concomitantly, Fyesa sought to cut its work force from 294 to 150. The company was said to be approaching the problem by offering either early retirement to its older workers or bonuses to redundant employees who resigned.

The restructuring at Fyesa was reflective of the general situation facing Spain's ferroalloys industry. High labor and energy expenditures severely diminished the ability of many of the country's producers to compete efficiently against low-cost ferroalloy makers such as Brazil and Venezuela. The situation was further exacerbated by EEC provisions enjoining the Spanish Government from subsidizing the industry. As a result, the country's ferroalloy producers began negotiations with the Spanish Government to identify alternative remedies that included furnace closure. It was expected that the restructuring process would be modeled closely on the rationalization and reduction undertaken by the steel industry the previous year.

Iron and Steel.—Negotiations between the Spanish steel producers and state officials resulted in a restructuring package approved by the Spanish Government. The package stipulated cuts of 4 million tons in steel productive capacity in 1987-88. Of those reductions, 3.3 million tons was mandated by Spain's EEC accession agreement.

As an incentive to meet the capacity goals, the Spanish Government offered $1.8 billion to strengthen the financial position of the steel industry, generally, and to soften the effects of layoffs at Acenor, AHV, ENSIDESA, and Forjas y Aceros de Reinosa S.A. (Forasa), specifically.

Acenor's SA Echevarria subsidiary overhauled its Forjas Basural works. Production of bar-in-coil at that facility was terminated and transferred to Forjas Alavesas. Although specific numbers were not ascertained, layoffs were considered probable and proportionate to the $237.8 million allocated by the Spanish Government for the purpose of downsizing operations. At the same time, the company intended to emphasize production of medium-size special steel bars, and it invested $24.2 million in improving Basurai's six-strand continuous caster.

AHV closed its bar mill and reduced sinter operations at Sestao, leaving the company to center its production on flat-rolled products. The closures resulted in work force reductions of 1,800. An additional 1,800 workers were scheduled to be offered either early retirement or redundancy pay. Reportedly, the company would not pursue reduced output of its flat-rolled products because demand for those items exceeded current supply and was expected to exceed supply in the foreseeable future. Further, the situation created potential displacement of AHV output by imports.

ENSIDESA temporarily closed its reinforcing bar operation at the Verina works, with a view toward permanent closure by yearend 1987. A shutdown of the 250,000-ton-per-year rebar mill would involve a loss of 300 jobs and would mark ENSIDESA's withdrawal from rebar production, leaving it to produce wire rod, of which it is capable of producing 480,000 tons annually. Private long products companies, minimills, and independent steel producers welcomed the shutdown as an important step in eliminating overcapacity in the steel products sector. ENSIDESA was eligible for subsidies and was expected to garner as much as $554.8 million of the official aid earmarked for the Spanish steel industry.

Forasa, Acenor's chief competitor in special steel and forging production, restructured its operations by eliminating 463 jobs at its Reinosa facility in northern Spain. Of the remaining 1,713 positions, an additional 402 were scheduled to be cut. No plans were announced regarding reduction of the then-current annual capacity of 150,000 tons. Concurrent with the downscaling of its labor force, Forasa received $63.9 million in Government aid that would assist in restructuring the company's debt burden.

Among the three big minimill works participating in the rationalization plan, Siderúrgica Sevillana (Riva Group) proposed the closure of the Dos Hermanas works of its subsidiary, Sidesur. The plant has a mill with an annual capacity of 971,000 tons of rebars and angles.

Consistent with its aim of scrapping 1.6 million tons of rolled products, Celsa planned to close the Sidegasa works as well as its rolling mill at its Castellbisball plant. Closure of those facilities would yield $69.2 million in Government aid that would work to reduce company debts of $96.7 million.

Orbegoz, the third minimill, proposed closure of the Lezo plant operated by its subsidiary Aceros Corrugados and a rolling mill at its Zumarraga works. The shutdowns would leave the works with a single electric furnace, two rolling mills, and one wire works. Annual productive capacity of raw steel would be reduced by 523,000 tons and rolled products by 383,000 tons. The closures were expected to net Orbegoz $85.8 million to be used, in part, to compensate laid-off workers.

Apart from the incentives it offered the steel industry to curb its productive capacity, the Spanish Government continued to invoke a "safeguard clause" within its agreement with the EEC, allowing Spain to impose ceilings on imported hot- and cold-rolled coil, hot-dipped galvanized sheet, and wire rod. The Government also restricted imports of hot-rolled coil from non-EEC nations by curtailing import licenses. Imports of hot-rolled coil from the U.S.S.R. were to be reduced from 25,000 tons to 4,000 tons. Elimination of an expected 20,000 tons from Canada and 35,000 tons from Turkey were under consideration. Motivating these actions were the fears of Spanish steel producers that the imports would displace domestically produced products. An additional source of concern was the possibility that EEC producers, whose exports were restricted under the safeguard clause, could attempt to penetrate the Spanish market via non-EEC market economy countries, a further detriment to domestic producers.

Lead.—Compañia La Cruz S.A., the Spanish lead producer, closed indefinitely its smelter at Linares, about 200 kilometers north of the Spanish port city of Málaga. Production at the 50,000-ton-per-year plant

was suspended as a result of the company's financial difficulties. Expecting to receive a sizable percentage of lead concentrate from the Aznalcollar Mine in southeastern Spain, La Cruz had invested in smelter modifications to handle the dirty concentrates of Aznalcollar. However, Sociedad Andalusa de Piritas S.A. (Apirsa), Aznalcollar's operator, contracted its entire annual output of 40,000 tons to Mark Rich, a competitor and trader in the lead market. Consequently, La Cruz had an insufficient supply of concentrates to sustain smelter production and was not able to recover its capital outlay. In addition, the prohibitive freight charges tied to the inland location of the Linares smelter, supply shortages, and attendant price inflation of foreign lead concentrates made importation of the material infeasible. Except for the small staff required to maintain equipment, nearly 350 employees were laid off as a result of the closure, and it was not expected that the facility would resume operations.

Mercury.—MAYASA discovered a mercury deposit able to produce 135,000 flasks of mercury. Exploitable reserves amounted to 21,000 tons. The new mine, situated at Almadén in southern Spain, will replace the company's depleted ore body at the same site and will increase the country's mercury reserves to 2.2 million flasks.

The new facility, expected to begin production in approximately 3 years, contains ore with a relatively high mercury content of 20.5%, an amount sufficient to reduce extraction costs by more than one-half. Compared with expenditures of $190 per flask at the company's opencast Entredicho Mine and $300 per flask at its old Almadén operation, costs at the new mine should average $87 per flask. It was expected that reduced production costs would result in a commensurate price drop from $300 per flask for MAYASA's mercury. Set in agreement with Algeria's Entreprise Nationale des Non-ferreux et Substances Utiles (ENOF) during the first quarter of 1987, the $300 quote was said to reflect the floor below which the Spanish mercury producer lost $4 million on sales the previous year. Market prices for mercury reached a low of $175 per flask in February 1987.

Reportedly, at yearend 1987, MAYASA began operating a 15,000-flask-per-year mercury recovery plant, designed to process mercury residues such as those captured in zinc processing. The plant, the largest of its type in Europe, was scheduled to employ 25 to 30 people, with annual output amounting to the total quantity of mercury residues recovered in Europe by similar processes from 1981 to 1986. The 15,000 flasks produced for domestic consumption were to be offset by an equal cut in primary metal production.

Polymetallics.—Boliden AB, the Swedish mining concern, purchased Apirsa from Banco Español for an undisclosed sum. The deal gave Boliden 100% ownership of Apirsa's Aznalcollar Mine, whose annual output amounts to 50,000 tons of zinc, 20,000 tons of lead, and 6,000 tons of copper. The ore body is a geological extension of the ore body on which the Neves-Corvo copper mine in Portugal has been developed. It was expected that the mine would continue output of a rate of 2 million tons per year into the 1990's. Zinc accounted for 50% of the mine's revenue. Reportedly, the Spanish facility would help replace the zinc concentrate supplies at Boliden's Black Angel Mine in Greenland, where supplies were expected to run out by mid-1988. It was also expected, however, that Boliden would not necessarily use Aznalcollar output to feed its smelters to the exclusion of export sales.

Tin.—During the second quarter of 1987, it was announced that Spain's only remaining tin mines would close permanently, the result of continued low tin prices. Minera-Adelaide curtailed production at its La Parilla tin-tungsten mine near Cáceres earlier in the year as a result of flooding complications. In 1986, La Parilla produced about 120 tons of tin and 45 tons of tungsten. Minas de San Finx S.A., near La Coruña, halted operations by yearend 1987. In recent years, annual output at San Finx averaged 110 tons.

Zinc.—During the first half of 1987, Asturiana de Zinc lost $12.6 million. Compared with the same period in 1986, the net loss was 5.3% greater on sales revenues that were 12% higher. The poor performance resulted from high energy tariffs and a lower exchange rate for the U.S. dollar, which cut the domestic price for zinc.

Reportedly, however, a number of parties expressed an interest in acquiring all or some part of the company, not only for the Aviles refinery but also Asturiana de Zinc's mining interests. These include the 150,000-ton-per-year Reocin Mine at Santander, as well as a 30% share in Exploracíon Minera Internacional España S.A. (EXMINESA), which runs the 70,000-ton-per-year Rubiales operation at Lugo and the 40,000-ton-per-year La Troya facility, 30 kilometers south of San Sebastián.

INDUSTRIAL MINERALS

Clays (Kaolin).—In July 1987, ECC Overseas Investments Ltd., a subsidiary of English China Clays PLC, United Kingdom, acquired a 75% share in Caosil S.A. for an undisclosed sum. Caosil quarries a mixed kaolinitic sand deposit at Peñalen in Guadalajara for wet processing at Villanueva de Alcoron. The kaolin extracted from the facility is marketed primarily to the ceramics and paper industries. The coarse and wet-milled sand is sold for bottle glass manufacture. In 1987, the Peñalen operation had an annual production capacity of about 36,500 tons, with output measured at about 25,000 tons. In addition, two grades of silica sand were produced at an annual rate of 95,000 tons, classified sand grading 98.2% SiO_2, 0.012% Fe_2O_3.

Magnesite (Dolomite).—Empresa Auxiliar de la Industria S.A. was expected to invest $207,400 in an evaluation of the possibilities for extracting magnesite from dolomite being mined at 10 sites at Granada in southern Spain. The value of the dolomite mineral was expected to increase significantly if it became a source for magnesite production. Additional investments of $153,600 and $57,600 each by the Andalusian regional government and the Provincial authority of Granada were to supplement Empresa Auxiliar's outlay.

Sodium Sulfate.—Foret S.A., Spanish subsidiary of FMC Corp., bought the natural sodium sulfate operation of Union Salinera de España S.A. The purchase included a combined glauberite-thenardite deposit at Castellar, Villarrubia de Santiago, in Toledo Province, as well as a 150,000-ton-per-year plant recently modernized to incorporate dissolution and vacuum evaporation technology. The new process, essentially a steam recycling system, consumes less energy than the submersion-combustion heating approach that preceded it. Reportedly, the sodium sulfate acquisition would meld synergistically with Foret's other activities, particularly supplying the domestic paper and detergent industries with chemical raw materials.

MINERAL FUELS

Coal.—In March 1987, 25 coal mines were shut down as a majority of the 21,000 coal miners employed by the Spanish coal producer Hunosa Co. either stayed home or picketed the Oviedo facilities, situated in Spain's northern Asturias region. The walkout was in protest of Hunosa's plan to eliminate 2,000 jobs by yearend 1988 and an additional 6,000 jobs by 1990. Simultaneously, Hunosa, whose output reportedly was 3.5 million tons of coal, planned a 5% increase in productivity from 1987 to 1993 via modernized equipment and more efficient management techniques.

Hunosa's rationalization plan was somewhat reflective of a broader effort by Spain's coal industry to consolidate many small producers into a few large corporations as a means of lowering costs and raising output. In 1987, only 43 of Spain's 223 coal mines produced more than 100,000 tons of coal per year. Another 47 companies accounted for 9.9% of the country's coal production, while the remaining 133 posted 5.4% of total output. Of that production, 92% was consumed by the country's electric power stations, 5% by the steel industry, and 3% by miscellaneous users.

Natural Gas.—In November 1987, Enegas, Spain's gas distribution company, signed a letter of intent promising to purchase natural gas from Soyuzgasexport, the Soviet natural gas enterprise, beginning in 1992. Purchases of between 1 to 1.5 billion cubic meters of gas were scheduled. Under one scenario, 500 million cubic meters would be bought in 1992, followed by an increase to 1 billion cubic meters between 1993 and 1998. By 2004, annual purchases would amount to 1.5 billion cubic meters. Unsolved, however, were the pricing formula and the route by which the gas would travel from the U.S.S.R. to Spain. One reported transportation possibility was through Spain's planned link to the European gas grid through the French pipeline network. Spain reportedly was negotiating a pipeline connection with Gaz de France as a means of receiving 1 billion cubic meters of gas per year from Norway's Troll and Sleipner North Sea oilfields beginning in 1990. The planned linkup was part of Spain's diversification effort to avoid sole reliance on Algeria for gas. Spain's natural gas contract with its other supplier, Libya, expires at the end of 1989.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Spanish pesetas (Ptas) to U.S. dollars at the rate of Ptas123.48=US$1.00, the average rate in 1987.

The Mineral Industry of Sweden

By Richard H. Singleton[1]

The Swedish economy enjoyed a somewhat improved year in 1987. The gross domestic product (GDP) increased about 2.5% to $158 billion,[2] industrial investment increased 15% to $5.6 billion, industrial production rose 3%, and the jobless rate decreased to 1.9%. The strong trend from traditional heavy industry to high technology and services continued. On the negative side, wages continued to soar, private consumption was up, the rate of inflation increased, and the current-account balance was $1 billion in the red after showing a $1 billion surplus in 1986.

Sweden was dependent on export trade, which increased 5% in 1987 to $44 billion. Imports increased by 10% to $40 billion. Nearly 10% of Sweden's export revenues usually came from the United States, but these decreased 10% in 1987 to $4.3 billion. Imports from the United States also decreased 10%, to $2.6 billion, despite the lower exchange rate for the dollar. More than 50% of Sweden's exports went to the European Community (EC) and about 20% went to Nordic countries.

The minerals industry accounted for approximately 3% of Sweden's GDP. Ninety percent of the value of the $4.2 billion per year industry was metals mining, smelting, and refining. Industrial minerals made up the remaining 10%. Steel billets accounted for about 70% of the value of the metals industry, followed by iron ore, ferrochrome, copper, aluminum, and zinc concentrate, in order of value. An approximate breakdown of the value of the major industrial minerals industries was cement, 30%; aggregate, 30%; and dimension stone, lime, and sulfur, about 10% each.

The value of crude steel production was estimated to be $2.8 billion in 1987, down 2% from the production value for 1986. Although the U.S. Government decided to continue countervailing duties on some Swedish steel, heavy European demand for stainless steel raised specialty steel production. Sweden's specialty steel producers and its integrated carbon steel producer announced plans to upgrade plants for more efficient production to meet unexpected demand.

Production of ferroalloys was down for the second consecutive year, at a value of $234 million in 1987 compared with $288 million in 1986. Production values of refined copper and lead rose for the second consecutive year, by 1% to $147 million for copper and by less than 1% to $46 million for lead. Production of zinc concentrate was relatively unchanged from that of 1986, with a value of $88 million. Boliden Minerals AB, Sweden's largest producer of copper, lead, and zinc concentrates and metal, proposed to expand and improve its mine and smelter productivity, efficiency, and profit. The Government delayed approval of the plans, claiming they conflicted with official policies that favor full employment and elimination of pollution. Gold exploration and mine development became more active.

PRODUCTION AND TRADE

Production of refined primary copper and lead increased significantly for the second successive year while imports of copper concentrate increased. Production of sulfide ores and iron ore from domestic mines decreased slightly. Production of ferrochrome decreased for the second year because of a smelter closure in 1986 coupled with delays in getting a new smelter onstream. No ferrosilicochrome was produced in 1987 because of the 1986 smelter closure. Sweden's output of fluorspar, a byproduct from the country's only tungsten mine, decreased significantly after 1985. Ammonia (nitrogen) output for fertilizer decreased significantly because of a plant closure. Approximately 950,000 tons of metallurgical coal was imported from the United States.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS					
Aluminum:					
Primary	82,156	r82,771	83,509	77,667	81,480
Secondary	17,434	17,557	17,545	18,144	8,820
Arsenic: Trioxide, refined[e]	9,000	10,000	10,000	10,000	10,000
Copper:					
Mine output, Cu content	76,540	r86,898	90,495	87,387	85,016
Metal:					
Smelter:					
Primary	78,756	79,775	74,668	83,358	92,909
Secondary	23,076	22,895	26,017	19,142	12,669
Total smelter	101,832	102,670	100,685	102,500	105,578
Refined:					
Primary	50,141	r56,440	46,997	68,688	80,877
Secondary[e]	13,216	r7,464	17,655	15,773	11,028
Total refined	63,357	63,904	64,652	84,461	91,905
Gold:					
Mine output, Au content—troy ounces	108,300	141,600	148,900	e130,000	e135,000
Metal, primary[2]—do	77,700	106,200	138,000	r e120,000	e125,000
Iron and steel:					
Iron ore and concentrate:					
Gross weight—thousand tons	14,265	18,123	20,454	20,489	19,707
Fe content—do	9,270	11,780	13,500	13,520	13,006
Metal:					
Pig iron and sponge iron—do	2,112	2,323	2,523	2,539	2,419
Ferroalloys:					
Ferrochromium	119,491	134,028	135,453	126,144	109,352
Ferrochromium-silicon	18,377	30,633	26,243	17,024	--
Ferromolybdenum	641	229	161	--	--
Ferrosilicon	19,406	23,278	28,279	19,969	19,949
Ferrotungsten	366	180	--	--	--
Total	158,281	188,348	190,136	163,137	129,301
Steel, crude—thousand tons	4,116	4,705	4,813	4,710	4,608
Semimanufactures, rolled—do	3,598	3,988	4,254	4,005	e4,000
Lead:					
Mine output, Pb content	85,762	r80,760	75,894	88,903	90,423
Metal:					
Smelter:					
Primary:					
Crude	26,025	15,878	15,535	6,512	1,439
Refined	34,780	49,758	43,221	49,160	61,229
Total primary	60,805	65,636	58,756	55,672	62,668
Secondary	15,170	27,737	25,861	27,783	30,185
Total smelter	75,975	93,373	84,617	83,455	92,853

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS —Continued					
Lead —Continued					
Metal —Continued					
Refined:					
Primary	34,780	49,758	43,222	49,160	61,229
Secondary	15,170	27,737	25,861	27,783	30,185
Total refined	49,950	77,495	69,083	76,943	91,414
Molybdenum, oxide, roasted, Mo content	1,698	1,064	1,486	2,170	2,121
Selenium, elemental, refined	42	68	46	r e50	e50
Silicon metal	20,340	20,206	19,755	e20,000	e20,000
Silver:					
Mine output, Ag content thousand troy ounces	6,655	7,676	7,442	7,555	6,912
Metal, primary[2] do.	5,284	r5,370	5,073	r e5,250	e4,800
Tungsten, mine output, W content	365	385	402	357	334
Zinc, mine output, Zn content	r216,805	r210,037	216,403	219,289	218,570
INDUSTRIAL MINERALS					
Cement, hydraulic thousand tons	2,240	2,393	2,124	2,119	e2,300
Clays: Kaolin	305	196	106	60	e100
Feldspar, salable, crude and ground	52,913	49,833	41,720	35,160	52,000
Fluorspar concentrate	2,042	3,454	3,169	265	220
Kyanite	--	--	2,200	e5,000	e5,000
Lime, mostly quicklime thousand tons	610	648	649	656	e650
Nitrogen: N content of ammonia do.	49	49	18	46	e45
Phosphate rock (byproduct):					
Gross weight do.	107	133	187	192	221
P_2O_5 content do.	41	51	71	71	82
Pyrite, gross weight do.	430	418	407	447	429
Quartz	13,041	17,539	17,298	e17,000	e17,000
Sodium sulfate[e] thousand tons	100	100	100	100	100
Stone:					
Dimension, mostly unfinished:					
Granite do.	r128	r138	148	169	e175
Limestone do.	15	15	15	e15	e15
Sandstone do.	3	4	3	e3	e3
Slate do.	29	22	21	21	e20
Crushed:					
Dolomite do.	645	r830	963	780	e800
Granite do.	9,892	9,873	8,060	6,888	e7,000
Limestone:					
For cement manufacture do.	r796	r842	765	913	e900
For lime manufacture do.	759	687	1,997	r e2,000	e2,000
For other construction and industrial uses do.	2,117	2,039	2,068	r e2,100	e2,000
Chalk (ground) do.	38	40	40	39	e40
Marl do.	2,717	2,718	2,314	r e2,500	e2,500
For agricultural uses (ground) do.	r307	r296	306	300	e300
For other uses (ground) do.	67	108	94	e100	e100
Total do.	r6,801	r6,730	7,584	7,952	e7,940
Quartzite do.	1,397	1,533	1,466	7,128	e1,500
Sandstone do.	140	138	123	r e125	e125
Other do.	610	666	690	r e700	e700
Sulfur:					
S content of pyrite do.	r219	r212	210	227	e220
Byproduct:					
From metallurgy do.	114	122	123	125	e130
From petroleum do.	20	26	23	49	e50
Total do.	353	r360	356	401	e400
Sulfuric acid do.	928	930	960	1,001	e1,000
Talc and steatite	21,056	17,882	14,400	2,000	800
MINERAL FUELS AND RELATED MATERIALS					
Carbon black thousand tons	24	26	31	r e30	e30
Coke, metallurgical do.	1,159	1,236	1,247	e1,200	e1,200
Peat, for agricultural use[e] do.	60	60	60	60	60

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
MINERAL FUELS AND RELATED MATERIALS — Continued					
Petroleum:					
Crude ---------- thousand 42-gallon barrels	172	98	60	30	24
Refinery products:					
Liquefied petroleum gas ---------- do	1,299	1,891	2,088	2,714	2,448
Naphtha ---------- do	1,640	1,700	1,096	1,530	1,726
Gasoline, motor ---------- do	21,326	27,931	25,466	26,868	[e]31,118
Jet fuel ---------- do	2,256	3,784	4,112	3,544	[e]4,704
Kerosene ---------- do	155	116	202	170	[e]256
Distillate fuel oil ---------- do	35,219	34,137	34,480	40,761	41,552
Residual fuel oil ---------- do	36,157	27,999	27,206	28,025	26,207
Other ---------- do	4,129	4,853	5,252	5,485	5,872
Refinery fuel and losses ---------- do	4,988	5,175	8,010	6,630	7,448
Total ---------- do	107,169	107,586	107,912	115,727	[e]121,331

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through July 30, 1988.
[2]Includes only that recovered from indigenous ores excluding scrap.

Table 2.—Sweden: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate ----------	541	--		
Oxides and hydroxides ----------	513	8,204	NA	Norway 8,017.
Metal including alloys:				
Scrap ----------	8,699	13,434	17	Finland 5,327; West Germany 4,247; Denmark 1,170.
Unwrought ----------	41,816	39,353	--	West Germany 19,025; United Kingdom 5,017; Netherlands 4,183.
Semimanufactures ----------	48,726	55,961	1,876	Denmark 11,671; United Kingdom 9,416; Norway 6,770.
Antimony: Metal including alloys, all forms ----------	([2])	25	--	All to Netherlands.
Cadmium: Metal including alloys, all forms ----------	15	--		
Chromium:				
Ore and concentrate ----------	13	36	--	All to Norway.
Oxides and hydroxides ----------	29	--		
Metal including alloys, all forms ---	4	--		
Cobalt:				
Oxides and hydroxides ----------	([2])	--		
Metal including alloys, all forms ---	125	78	3	Brazil 14; France 13; United Kingdom 13.
Columbium and tantalum: Metal including alloys, all forms, tantalum -----	([2])	--		
Copper:				
Ore and concentrate ----------	108,707	83,164	--	Finland 42,207; Norway 19,510; West Germany 10,687.
Oxides and hydroxides ----------	2	--		
Sulfate ----------	48	--		
Ash and residue containing copper --	5,892	7,439	--	Belgium-Luxembourg 6,318; France 1,100.
Metal including alloys:				
Scrap ----------	3,624	4,866	--	Denmark 3,438; Poland 730; Finland 184.
Unwrought ----------	54,207	58,648	73	United Kingdom 26,855; Belgium-Luxembourg 18,229; West Germany 7,934.
Semimanufactures ----------	75,616	81,867	100	Norway 9,618; United Kingdom 8,249.

See footnotes at end of table.

Table 2.—Sweden: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Gold:				
Waste and sweepings value, thousands	$2,677	$13,542	NA	United Kingdom $6,,463; West Germany $5,135; Switzerland $1,523.
Metal including alloys, unwrought and partly wrought ____do____	$50,966	$90,740	NA	NA.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	18,302	17,219	136	West Germany 4,507; Belgium-Luxembourg 2,902; France 2,407.
Pyrite, roasted_____do____	(2)	1	--	Mainly to United Kingdom.
Metal:				
Scrap	21,631	28,585	1	Italy 11,275; Spain 5,162; Netherlands 3,190.
Pig iron, cast iron, related materials	108,202	113,674	3,796	West Germany 15,998; Japan 15,723; United Kingdom 10,209.
Ferroalloys:				
Ferrochromium	103,121	85,276	NA	NA.
Ferromanganese	1,167	2,009	NA	United Kingdom 1,598; Turkey 247; Hungary 80.
Ferromolybdenum	101	58	NA	Vietnam 10; Norway 9; Finland 8.
Ferronickel	3	--	--	
Ferrosilicochromium	2,226	2,073	NA	West Germany 1,211; U.S.S.R. 701; Japan 100.
Ferrosilicomanganese	65	464	NA	United Kingdom 412.
Ferrosilicon	21,416	11,480	NA	NA.
Unspecified	343	265	58	Finland 47; United Kingdom 31.
Steel, primary forms	761,882	694,316	354,016	West Germany 84,604; Italy 78,543.
Semimanufactures:				
Bars, rods, angles, shapes, sections	867,357	807,406	62,610	West Germany 207,738; Denmark 89,910; United Kingdom 89,119.
Universals, plates, sheets	991,546	931,394	80,551	West Germany 164,462; Denmark 140,110; Norway 113,466.
Hoop and strip	120,237	126,615	13,802	West Germany 27,136; Denmark 18,744.
Rails and accessories	41,241	21,259	485	Norway 12,360; United Kingdom 3,724; India 1,914.
Wire	67,261	65,128	8,592	West Germany 11,439; Finland 7,283.
Tubes, pipes, fittings	243,321	224,712	25,108	West Germany 38,913; France 21,419.
Castings and forgings, rough	3,016	4,821	7	Norway 2,117; Finland 1,290; Denmark 419.
Lead:				
Ore and concentrate	42,962	58,048	--	West Germany 31,369; Belgium-Luxembourg 18,780; U.S.S.R. 3,200.
Oxides	146	--		
Metal including alloys:				
Scrap	165	573	--	Denmark 540; Cyprus 32.
Unwrought	64,772	65,688	3,014	Norway 11,654; Denmark 8,427; West Germany 8,257.
Semimanufactures	404	594	(2)	United Kingdom 378; Denmark 134; Norway 53.
Magnesium: Metal including alloys:				
Scrap	674	864	50	West Germany 438; Netherlands 147; Denmark 56.
Unwrought	1	(2)	--	All to United Kingdom.
Semimanufactures	221	66	NA	Denmark 16; Norway 2; unspecified 48.
Manganese:				
Ore and concentrate, metallurgical-grade	24	--		
Oxides	1	--		
Metal including alloys, all forms	86	113	NA	Finland 62; Norway 28.
Mercury ____ 76-pound flasks	--	319	NA	NA.
Molybdenum:				
Ore and concentrate	1,375	1,687	--	Netherlands 1,474; Finland 145; West Germany 65.
Oxides and hydroxides	42	--		
Metal including alloys, all forms	118	6	NA	NA.
Nickel: Metal including alloys:				
Scrap	533	648	10	West Germany 250; United Kingdom 183; Netherlands 140.
Unwrought	96	52	--	Netherlands 33; United Kingdom 11; Finland 3.
Semimanufactures	1,476	1,361	346	West Germany 197; Italy 125.

See footnotes at end of table.

Table 2.—Sweden: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$1,248	$1,962	$27	Netherlands $947; Norway $225; United Kingdom $200.
Silicon, high-purity do	$20,141	$23,879	NA	NA.
Silver:				
Ore and concentrate[3] do	$70	--		
Waste and sweepings[3] do	$15,822	$18,733	$2,588	United Kingdom $5,941; West Germany $4,754; Norway $3,565.
Metal including alloys, unwrought and partly wrought thousand troy ounces	6,334	9,099	--	Finland 514; unspecified 8,520.
Tin: Metal including alloys:				
Scrap	1	1	--	Mainly to Finland.
Unwrought	163	118	--	Norway 53;Denmark 43; Finland 22.
Semimanufactures	154	136	--	Denmark 78; Norway 53; Finland 4.
Titanium:				
Ore and concentrate	5	--		
Oxides	77	--		
Metal including alloys, all forms	188	189	50	United Kingdom 138.
Tungsten:				
Ore and concentrate	193	394	--	All to West Germany.
Metal including alloys, all forms	194	52	NA	United Kingdom 38; West Germany 6.
Zinc:				
Ore and concentrate	426,511	437,695	--	France 84,105; Norway 79,326; Finland 79,019.
Oxides	484	525	NA	West Germany 252; Norway 196.
Blue powder	14	--		
Ash and residue containing zinc	33,061	23,144	--	Norway 18,316; Belgium-Luxembourg 3,943; West Germany 396.
Metal including alloys:				
Scrap	2,457	2,877	--	Norway 1,016; West Germany 698; United Kingdom 277.
Unwrought	1,104	973	495	Denmark 219; Norway 209.
Semimanufactures	28	34	--	West Germany 16; Norway 6; Finland 4.
Zirconium:				
Ore and concentrate	30	--		
Metal including alloys, all forms	15	21	--	All to United Kingdom.
Other:				
Oxides and hydroxides	25	84	NA	Norway 49; West Germany 30.
Ashes and residues	9,553	5,175	--	Netherlands 1,076; East Germany 358; United Kingdom 321.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	49	243	--	Finland 236; Austria 1; Norway 1.
Artificial:				
Corundum	48	44	NA	NA.
Silicon carbide	416	91	NA	NA.
Dust and powder of precious and semi-precious stones including diamond value, thousands	$31	$5	--	Finland $1; Norway $1; Switzerland $1.
Grinding and polishing wheels and stones	1,940	2,011	1	U.S.S.R. 543; France 265; United Kingdom 264.
Barite and witherite	4	--		
Boron materials:				
Crude natural borates	--	1	--	All to Norway.
Oxides and acids	20	--		
Cement	655,666	548,694	NA	NA.
Chalk	8,668	8,329	--	Finland 4,132; Norway 2,721; Denmark 1,056.
Clays, crude:				
Bentonite	90	--		
Kaolin	4,466	1,558	--	Finland 1,261.
Unspecified	4,556	5,191	--	Norway 2,912; Italy 1,226; West Germany 173.

See footnotes at end of table.

Table 2.—Sweden: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Diamond:				
Gem, not set or strung value, thousands	$2,545	$1,825	$17	Belgium-Luxembourg $669; Finland $503; Denmark $304.
Industrial stones ——do——	$74	$49	--	United Kingdom $23; Netherlands $17; Argentina $6.
Diatomite and other infusorial earth	611	47	--	Norway 32; Finland 4; Israel 3.
Feldspar, fluorspar, related materials:				
Fluorspar	4,939	557	NA	Finland 411.
Unspecified	21,803	22,273	NA	United Kingdom 12,031; East Germany 4,100; Austria 2,483.
Fertilizer materials:				
Crude, n.e.s	1,006	1,266	--	West Germany 492; Norway 425; United Kingdom 145.
Manufactured:				
Ammonia	609	912	NA	Norway 882.
Nitrogenous	243,508	260,134	--	NA.
Phosphatic	69,827	63,953	--	NA.
Potassic	4	--		
Unspecified and mixed	201,612	201,656	--	NA.
Graphite, natural	128	5	--	Mozambique 2; Norway 2; Denmark 1.
Gypsum and plaster	377	290	--	NA.
Lime	18,699	17,309	NA	Denmark 8,072; Norway 4,895; Netherlands 2,085.
Magnesium compounds	1,869	575	--	Norway 468; Finland 19; Republic of Korea 7.
Mica:				
Crude including splittings and waste	20	46	--	West Germany 43.
Worked including agglomerated splittings	3	1	NA	NA.
Phosphates, crude	98,426	132,725	--	Norway 86,751; Denmark 39,611; West Germany 3,853.
Pigments, mineral: Iron oxides and hydroxides, processed	971	286	NA	NA.
Precious and semiprecious stones other than diamond:				
Natural ——— value, thousands	$6,862	$5,609	--	Belgium-Luxembourg $4,593; Denmark $521; Switzerland $237.
Synthetic ——do——	$25,762	$24,718	--	Ireland $24,350; Finland $365; West Germany $2.
Pyrite, unroasted	30	14	--	Venezuela 10; Thailand 4.
Salt and brine	2,063	1,835	--	Norway 682; Denmark 456; Belgium-Luxembourg 369.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	255	305	NA	NA.
Sulfate, manufactured	90,938	99,004	NA	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked thousand tons	191	172	1	West Germany 63; Italy 34; Denmark 24.
Worked ——do——	20	20	(2)	Denmark 10; Norway 6; West Germany 2.
Dolomite, chiefly refractory-grade do	36	39	--	Denmark 9; Netherlands 9; Norway 9.
Gravel and crushed rock ——do——	1,607	1,611	--	Denmark 769; West Germany 601; United Kingdom 105.
Limestone other than dimension do	845	857	--	Finland 748; Denmark 90; West Germany 11.
Quartz and quartzite ——do——	424	298	(2)	Norway 285; Denmark 6; West Germany 2.
Sand other than metal-bearing do	117	112	--	Norway 54; Denmark 50; West Germany 7.
Sulfur:				
Elemental:				
Crude including native and by-product	1,502	10,246	--	United Kingdom 9,079; Finland 1,161; Netherlands 6.
Colloidal, precipitated, sublimed	25	9,286	--	France 9,285.
Dioxide	34,690	24,973	NA	Finland 14,274; West Germany 4,810; Norway 2,679.
Sulfuric acid	21,645	244,248	34,737	Netherlands 110,608; Belgium-Luxembourg 59,705.

See footnotes at end of table.

Table 2.—Sweden: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Talc, steatite, soapstone, pyrophyllite	12,305	8,144	--	Netherlands 4,585; Denmark 1,158; Norway 1,116.
Other:				
Crude	6,530	6,195	(2)	Norway 3,921; Denmark 1,620; Finland 160.
Slag and dross, not metal-bearing	106,502	88,111	(2)	United Kingdom 36,724; Finland 23,880; Republic of South Africa 20,072.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1	8	--	East Germany 5; Denmark 2; Norway 1.
Carbon black	16,963	18,149	NA	Poland 5,804; Denmark 2,628; East Germany 2,559.
Coal:				
Anthracite	--	3,178	--	Ireland 3,173.
Bituminous	112,014	55,221	--	Ireland 46,664; United Kingdom 6,203; Norway 1,446.
Coke and semicoke	77,189	141,863	--	Finland 110,329; West Germany 11,477; Norway 11,418.
Peat including briquets and litter	36,763	51,090	--	Norway 25,281; Denmark 13,320; Netherlands 9,428.
Petroleum:				
Crude thousand 42-gallon barrels	689	974	--	France 876; United Kingdom 98.
Refinery products:				
Liquefied petroleum gas value, thousands	$24,047	$18,207	$3,818	United Kingdom $6,020; France $2,902.
Gasoline thousand 42-gallon barrels	7,761	8,942	--	Denmark 3,403; Norway 2,772; West Germany 1,589.
Mineral jelly and wax do	1	3	(2)	Norway 2.
Kerosene and jet fuel do	963	417	--	Denmark 323; Norway 88; India 4.
Distillate fuel oil do	16,251	17,059	--	Denmark 7,002; West Germany 6,279; Norway 1,473.
Lubricants do	1,136	1,248	(2)	Norway 356; Netherlands 255; United Kingdom 201.
Residual fuel oil do	13,588	16,006	936	United Kingdom 4,572; Belgium-Luxembourg 3,234; Denmark 2,523.
Bitumen and other residues do	1,773	1,783	--	Norway 863; Denmark 513; Finland 181.
Bituminous mixtures do	56	56	8	Belgium-Luxembourg 9; Finland 6.
Petroleum coke do	(2)	--		

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	52,073	50,056	--	West Germany 16,622; Netherlands 12,657; France 9,568.
Oxides and hydroxides	242,730	187,583	38	Venezuela 62,147; West Germany 42,934; Jamaica 31,511.
Metal including alloys:				
Scrap	1,507	1,621	(2)	Norway 671; United Kingdom 510; Denmark 252.
Unwrought	46,265	54,269	3	Norway 23,587; Canada 17,583; Finland 2,646.
Semimanufactures	77,341	86,279	549	West Germany 26,408; Norway 8,240; France 7,240.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Antimony: Metal including alloys, all forms	23	--		
Arsenic: Metal including alloys, all forms	930	--		
Beryllium: Metal including alloys, all forms	(2)	(2)	(2)	
Cadmium: Metal including alloys, all forms	260	201	--	Finland 141; Norway 60.
Chromium:				
Ore and concentrate	387,240	387,876	NA	NA.
Oxides and hydroxides	987	791	(2)	Poland 431; West Germany 257; United Kingdom 68.
Metal including alloys, all forms	248	322	NA	United Kingdom 258; France 62.
Cobalt:				
Oxides and hydroxides	8	10	7	Netherlands 2.
Metal including alloys, all forms	488	433	51	Zambia 148; Belgium-Luxembourg 91.
Columbium and tantalum: Metal including alloys, all forms, tantalum	1	1	NA	Mainly from United Kingdom.
Copper:				
Ore and concentrate	106,474	48,571	--	Chile 20,320; Norway 14,941; Philippines 3,447.
Matte and speiss including cement copper	5,042	7,012	--	France 6,883; Finland 129.
Oxides and hydroxides	768	693	NA	Yugoslavia 301; West Germany 142; Australia 110.
Sulfate	997	880	NA	U.S.S.R. 417; Czechoslovakia 170; Israel 160.
Ash and residue containing copper	22,902	29,376	6,689	West Germany 18,764; United Kingdom 2,723.
Metal including alloys:				
Scrap	21,275	10,831	2,715	United Kingdom 2,688; France 2,044.
Unwrought	61,247	62,245	15	West Germany 9,606; Canada 8,971; Zambia 8,533.
Semimanufactures	41,017	42,545	100	West Germany 18,002; West Germany 18,002; United Kingdom 5,618; Belgium-Luxembourg 4,919.
Gold:				
Waste and sweepings value, thousands	$690	$433	--	Denmark $187; Finland $171; Norway $75.
Metal including alloys, unwrought and partly wrought ---do---	$6,014	$12,269	$114	West Germany $6,465; United Kingdom $3,539; Switzerland $892.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	67,950	67,712	--	Norway 67,266; Netherlands 225; United Kingdom 221.
Pyrite, roasted	6,869	--		
Metal:				
Scrap	884,890	698,236	11,662	United Kingdom 271,197; U.S.S.R. 195,239; West Germany 79,764.
Pig iron, cast iron, related materials	56,639	65,804	227	U.S.S.R. 20,477; Canada 13,448; Brazil 10,759.
Ferroalloys:				
Ferrochromium	52,006	42,967	156	Finland 13,820; Republic of South Africa 12,747; U.S.S.R. 5,665.
Ferromanganese	28,406	26,464	--	Norway 16,918; Republic of South Africa 5,193; France 3,995.
Ferromolybdenum	1,377	1,388	63	Austria 265; Spain 243; United Kingdom 221.
Ferronickel	7,317	13,403	41	New Caledonia 6,205; Greece 2,786; Dominican Republic 2,504.
Ferrosilicochromium	1,645	100	--	U.S.S.R. 99.
Ferrosilicomanganese	15,696	17,559	--	Norway 11,997; Republic of South Africa 3,361; Czechoslovakia 1,854.
Ferrosilicon	21,251	17,177	--	Norway 15,516; France 621; West Germany 551.
Unspecified	3,710	4,603	551	U.S.S.R. 837; West Germany 792; United Kingdom 616.
Steel, primary forms	71,030	94,730	1,345	West Germany 44,898; United Kingdom 20,148; Japan 10,704.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections	413,208	415,152	1,391	West Germany 94,275; United Kingdom 55,743; Finland 45,548.
Universals, plates, sheets	789,459	857,662	32	West Germany 216,256; Belgium-Luxembourg 177,716; France 108,793.
Hoop and strip	133,035	135,265	91	West Germany 55,803; United Kingdom 18,867; Finland 13,407.
Rails and accessories	4,008	4,216	--	United Kingdom 2,196; West Germany 931; Austria 401.
Wire	31,177	30,613	47	Belgium-Luxembourg 9,545; Finland 5,253; France 5,153.
Tubes, pipes, fittings	317,134	309,121	114	West Germany 66,264; Finland 52,189; United Kingdom 41,728.
Castings and forgings, rough	10,316	9,165	2	Denmark 2,682; Norway 2,510; West Germany 1,934.
Lead:				
Ore and concentrate	6,592	--		
Oxides	3,905	4,397	6	West Germany 2,757; France 583; United Kingdom 533.
Metal including alloys:				
Scrap	20,660	16,469	43	Norway 6,385; Finland 4,606; Denmark 3,891.
Unwrought	4,811	3,825	--	United Kingdom 2,842; Denmark 332; West Germany 180.
Semimanufactures	1,092	1,321	1	West Germany 1,035; Netherlands 138; United Kingdom 113.
Magnesium: Metal including alloys:				
Scrap	1	--		
Unwrought	1,688	1,840	63	Norway 1,771; United Kingdom 6.
Semimanufactures	111	132	5	Norway 45; West Germany 35; Switzerland 21.
Manganese:				
Ore and concentrate, metallurgical-grade	336	12,097	--	Brazil 11,978; Netherlands 102; France 17.
Oxides	255	227	202	West Germany 14; Finland 5.
Metal including alloys, all forms	1,073	1,726	NA	Republic of South Africa 860; France 705; China 121.
Mercury 76-pound flasks	464	1,363	--	Algeria 348; Yugoslavia 290; U.S.S.R. 261.
Molybdenum:				
Ore and concentrate	6,481	7,246	3,038	Chile 2,370; Netherlands 886.
Oxides and hydroxides	125	96	--	West Germany 86; Chile 10.
Metal including alloys, all forms	137	169	19	West Germany 130; Austria 12.
Nickel:				
Ore and concentrate	--	18	--	All from Australia.
Matte and speiss	2,603	3,513	--	Do.
Metal including alloys:				
Scrap	5,678	6,689	1,848	West Germany 2,319; United Kingdom 1,430.
Unwrought	12,284	10,343	611	United Kingdom 2,836; Canada 2,297; Republic of South Africa 1,043.
Semimanufactures	1,113	855	97	United Kingdom 490; West Germany 117.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$29,216	$42,255	$8,291	Switzerland $17,438; United Kingdom $8,511.
Selenium, elemental	41	8	NA	Finland 5.
Silicon, high-purity and metal	387	630	NA	France 368; Norway 204; West Germany 22.
Silver:				
Ore and concentrate[3] value, thousands	$29,184	$29,970	$4,057	Peru $12,179; Chile $6,698.
Waste and sweepings[3] do.	$6,692	$9,015	$6,283	Finland $1,450; France $836.
Metal including alloys, unwrought and partly wrought thousand troy ounces	5,370	5,562	32	West Germany 2,572; France 1,382; United Kingdom 643
Tin: Metal including alloys:				
Scrap	87	58	--	Denmark 45; Finland 9; Norway 3.
Unwrought	577	643	(2)	United Kingdom 253; Malaysia 191; West Germany 66.
Semimanufactures	133	130	(2)	Netherlands 58; West Germany 41; United Kingdom 27.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Titanium:				
Ore and concentrate	4,636	22,656	NA	Australia 22,581.
Oxides	4,861	5,039	195	Norway 2,068; Finland 878; West Germany 616.
Metal including alloys, all forms	45	38	24	United Kingdom 5; West Germany 4.
Tungsten:				
Ore and concentrate	1,150	1,351	--	Australia 406; France 275; Canada 216.
Oxides and hydroxides	7	--		
Metal including alloys, all forms	42	212	5	Israel 115; United Kingdom 29; West Germany 23.
Zinc:				
Ore and concentrate	5	--		
Oxides	1,321	1,664	--	West Germany 521; United Kingdom 409; Netherlands 347.
Blue powder	388	294	--	Norway 265; West Germany 23.
Ash and residue containing zinc	29,246	21,386	5,515	West Germany 12,419; United Kingdom 1,970.
Metal including alloys:				
Scrap	96	192	--	Norway 108; Denmark 84.
Unwrought	35,188	35,943	--	Norway 18,068; Finland 14,026; Poland 1,138.
Semimanufactures	193	233	(2)	West Germany 127; Norway 46; Poland 32.
Zirconium:				
Ore and concentrate	3,113	4,268	NA	Netherlands 643; Republic of South Africa 500.
Metal including alloys, all forms	128	193	36	France 140; United Kingdom 11.
Other:				
Oxides and hydroxides	728	787	67	United Kingdom 317; Belgium-Luxembourg 215.
Ashes and residues	13,784	13,334	755	Norway 7,458; West Germany 1,685; France 973.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	2,933	1,172	2	Italy 387; Greece 274; West Germany 271.
Artificial:				
Corundum	6,116	5,910	542	West Germany 3,625; Hungary 526; United Kingdom 511.
Silicon carbide	6,470	4,950	NA	Norway 3,568; West Germany 939; Netherlands 322.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$3,533	$3,633	$71	Ireland $2,789; Switzerland $894; Netherlands $209.
Grinding and polishing wheels and stones	2,954	2,715	76	Austria 1,025; West Germany 497; France 274.
Asbestos, crude	1,042	1,069	--	All from Canada.
Barite and witherite	5,606	6,804	--	West Germany 6,035; China 329; United Kingdom 152.
Boron materials:				
Crude natural borates	14,718	13,807	4,280	Turkey 8,826; Netherlands 701.
Elemental	1	NA		
Oxides and acids	887	772	74	France 304; Turkey 183.
Cement	200,025	207,609	34	East Germany 106,292; U.S.S.R. 75,467; Denmark 16,045.
Chalk	25,972	23,148	13	West Germany 10,146; Denmark 5,739; Norway 4,164.
Clays, crude:				
Bentonite	6,026	9,228	62	Cyprus 4,340; United Kingdom 3,973; West Germany 445.
Kaolin	419,400	386,492	28,103	United Kingdom 330,516; Czechoslovakia 15,067.
Unspecified	39,269	35,603	2,500	United Kingdom 20,362; West Germany 5,249; Czechoslovakia 3,364.
Cryolite and chiolite	1,110	170	--	Denmark 169; Norway 1.
Diamond:				
Gem, not set or strung value, thousands	$9,353	$7,677	$49	Belgium-Luxembourg $4,254; Israel $1,051; United Kingdom $846.
Industrial stones ---do---	$753	$608	$21	United Kingdom $193; Netherlands $169; Belgium-Luxembourg $68.
Diatomite and other infusorial earth	2,826	2,298	653	Denmark 769; Iceland 201.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Feldspar, fluorspar, related materials:				
Fluorspar	9,929	10,648	--	Mexico 8,090; East Germany 1,343; United Kingdom 708.
Unspecified	11,860	13,392	--	Norway 12,154; Finland 884; West Germany 334.
Fertilizer materials:				
Crude, n.e.s	44	23	--	All from West Germany.
Manufactured:				
Ammonia	277,932	196,056	12,943	U.S.S.R. 110,950; Poland 51,079; West Germany 14,127.
Nitrogenous	591,314	587,667	NA	Norway 385,279; West Germany 58,439; unspecified 70,898.
Phosphatic	52	1,532	--	All from Belgium-Luxembourg.
Potassic value, thousands	$16,634	$16,894	$290	West Germany $11,520; France $2,208; U.S.S.R. $1,540.
Unspecified and mixed	307,013	262,066	100	Norway 169,536; Netherlands 26,123; West Germany 20,932.
Graphite, natural	743	570	22	West Germany 239; United Kingdom 149; China 90.
Gypsum and plaster	290,109	291,701	121	Norway 169,536; Netherlands 26,123; West Germany 20,932.
Lime	7,519	3,473	--	West Germany 1,116; Denmark 1,021; Finland 1,016.
Magnesium compounds	28,126	23,453	122	China 8,087; Greece 2,800; United Kingdom 2,594.
Mica:				
Crude including splittings and waste	447	399	--	Norway 117; United Kingdom 87; India 72.
Worked including agglomerated splittings	76	90	(2)	Switzerland 55; Austria 11; Belgium-Luxembourg 11.
Nitrates, crude	4,600	4,033	--	All from Chile.
Phosphates, crude	749,688	588,417	81,802	U.S.S.R. 279,406; Morocco 196,334.
Phosphorus, elemental	28	26	--	All from West Germany.
Pigments, mineral: Iron oxides and hydroxides, processed	6,323	4,209	5	West Germany 3,406; Spain 316; United Kingdom 268.
Potassium salts, crude	2,175	2,099	--	All from West Germany.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$4,216	$1,964	$250	Thailand $691; West Germany $384; Switzerland $318.
Synthetic do.	$2,237	$2,124	$1,792	Finland $57; Switzerland $50.
Pyrite, unroasted	21,970	48,807	--	Norway 38,384; Finland 10,253; West Germany 166.
Salt and brine thousand tons	1,256	1,269	(2)	West Germany 360; Netherlands 300; Denmark 140.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	106,443	95,318	15,928	East Germany 38,840; West Germany 26,025.
Sulfate, manufactured	19,454	19,232	NA	East Germany 8,697; United Kingdom 4,586; Belgium-Luxembourg 3,119.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	5,189	6,908	(2)	Finland 2,500; Norway 1,919; India 1,219.
Worked	10,751	13,362	--	Portugal 6,593; Italy 3,770; Finland 698.
Dolomite, chiefly refractory-grade	137,195	150,078	--	United Kingdom 60,266; Belgium-Luxembourg 47,455; Norway 37,006.
Gravel and crushed rock	70,091	73,751	6	Norway 35,219; Denmark 11,334; Finland 10,722.
Limestone other than dimension	51,538	51,659	--	Denmark 26,562; Norway 14,780; United Kingdom 8,565.
Quartz and quartzite	59,133	63,517	28	Spain 59,156; West Germany 1,909; Finland 1,680.
Sand other than metal-bearing	379,303	286,944	32	Denmark 141,378; Belgium-Luxembourg 119,925; United Kingdom 19,252.
Sulfur:				
Elemental:				
Crude including native and by-product	6,318	8,465	--	Poland 5,902; Norway 2,179; West Germany 237.
Colloidal, precipitated, sublimed	12,004	9,898	--	Poland 9,836; West Germany 62.
Dioxide	11,733	8,813	--	Norway 8,812.
Sulfuric acid	28,501	1,404	(2)	Norway 1,148; West Germany 226.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Talc, steatite, soapstone, pyrophyllite	26,349	27,263	55	Finland 12,449; Norway 6,847; Belgium-Luxembourg 4,205.
Other:				
Crude	220,773	183,709	230	Norway 166,930; West Germany 2,380; France 863.
Slag and dross, not metal-bearing	32,597	32,392	22	West Germany 9,225; Netherlands 8,931; Norway 7,807.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	653	749	246	Trinidad and Tobago 435; West Germany 40.
Carbon black	12,147	14,271	414	West Germany 7,250; Netherlands 5,592; United Kingdom 889.
Coal:				
Anthracite thousand tons	30	19	--	China 10; Belgium-Luxembourg 8.
Bituminous do	4,804	4,414	1,160	Australia 1,215; Poland 1,062.
Briquets of anthracite and bituminous coal do	(2)	1	--	All from West Germany.
Lignite including briquets do	3	3	--	East Germany 2; West Germany 1.
Coke and semicoke do	382	365	36	Japan 79; Australia 36.
Peat including briquets and litter	24,231	49,600	--	Finland 41,019; United Kingdom 4,653; U.S.S.R. 3,572.
Petroleum:				
Crude thousand 42-gallon barrels	101,260	116,487	--	United Kingdom 47,693; Norway 24,501; U.S.S.R. 9,086.
Refinery products:				
Liquefied petroleum gas do	4,045	6,397	--	Denmark 2,165; Norway 1,903; United Kingdom 1,463.
Gasoline do	20,264	21,293	25	United Kingdom 4,526; Finland 3,741; Denmark 3,601.
Mineral jelly and wax do	112	116	1	West Germany 71; United Kingdom 13; Hungary 10.
Kerosene and jet fuel do	1,959	2,746	(2)	Netherlands 754; Finland 593; United Kingdom 527.
Distillate fuel oil do	21,857	21,195	1,459	U.S.S.R. 4,747; Denmark 4,248; East Germany 3,958.
Lubricants do	2,029	1,714	21	Netherlands 437; United Kingdom 433; West Germany 254.
Residual fuel oil do	19,457	23,714	--	U.S.S.R. 6,269; United Kingdom 4,923; Netherlands 2,983.
Bitumen and other residues do	243	667	NA	Mainly from Finland.
Bituminous mixtures do	32	31	1	Finland 12; France 8; United Kingdom 3.
Petroleum coke do	279	759	317	United Kingdom 164; Belgium-Luxembourg 143.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

COMMODITY REVIEW

METALS

Copper.—Boliden, Sweden's largest producer of copper concentrate and its only producer of copper metal, at its Ronnskar smelter, proposed in September a comprehensive $500 million plan to expand its copper-zinc-lead mining operations in northern Sweden to help ensure a constant supply of raw material for its smelter into the next century. Reserves were depleting rapidly; the Aitik Mine, which supplied nearly one-half of Sweden's copper concentrate, had reserves sufficient for only 10 to 15 years and the Näsliden copper-zinc mine in the Kristineberg district was exhausted and closed. Boliden sought significant Government financial support for its plan. The Government officials disagreed with Boliden's optimistic estimate of the higher employment after the expansion, and they said Boliden's mining and smelting operations both caused serious pollution problems. Boliden was appealing at yearend stringent

proposed environmental regulations, particularly because meeting them would significantly curtail copper and lead output from the Ronnskar smelter. The company at midyear had revealed a $10 million program to keep its smelter open while it reduced sulfur dioxide (SO_2) emissions by 50%. The plan was to close several outdated copper and lead production lines as well as sulfuric acid and liquefied SO_2 plants. Except for sulfur dioxide, production levels would be maintained through efficiency improvements and capacity increases in the newer lines and plants. Boliden continued to send its zinc concentrate to Norway's Norzinc A/S plant for smelting. Boliden was one-half owner of Norzinc.

Ferroalloys.—Swedechrome AB began production of ferrochrome in its new plasma arc smelter at Malmö in October. One of the two furnaces operated continuously during the fourth quarter at somewhat below its 40,000-ton-per-year capacity. Operational difficulties in the subsystems not related to the basic plasma reduction process had prevented the smelter from going on-stream earlier in the year. It did not approach full capacity by yearend as planned. A small amount of ferrochrome was made early in the year, but continuous production could not be maintained at that time. The company declared force majeure at midyear on its deliveries.

Gold.—Boliden expanded gold production in three mines in northern Sweden at a cost of about $4 million per mine; these were two copper-zinc mines, Kristineberg and Renstrom, that produced byproduct gold, and Enåsen, a gold mine with copper and silver byproducts. Näsliden, a copper-zinc mine with byproduct gold, was closed. Loussavaara Kiirunavaara AB (LKAB), Sweden's major iron ore producer, conducted exploratory drilling for gold near Falun in central Sweden after completing seismic exploration during 1986. Terra Mining AB began developing, near Skelleftea in northern Sweden, a gold deposit that was reputed to contain about 300,000 troy ounces of gold.

Iron Ore.—The Swedish Government purchased at yearend the Grängesberg Mine from Svenskt Stål (SSAB) for 1 krona. The deal was made retroactive to January 1 so that the financial loss incurred during the year could be transferred to the state. Government aid was an unacceptable means of keeping the mine in the company's hands because it would inhibit SSAB's exports of steel products to the United States. The Swedish Ministry of Industry guaranteed it would keep the mine operating until 1991, mostly to continue worker employment. SSAB had declared in February its intention to close the two mines remaining in central Sweden, Grängesberg and the smaller Dannemora Mine, in 1989 as part of its rationalization program. Dannemora, about one-third as large as Grängesberg, was less likely to operate at a loss than the larger mine and remained within the company. Total output of the two mines during 1987 accounted for about 13% of Sweden's total production of iron ore. Approximately 35% of this output went to SSAB's Oxelösund steelworks and the remainder was exported. SSAB argued that it was less costly to import iron ore or purchase it from LKAB.

State-owned LKAB produced 87% of Sweden's iron ore from two deep mines north of the Arctic Circle and accounted for 93% of export sales. Profitability decreased because of falling world market prices caused by the falling U.S. dollar and inroads into the world market caused by low-cost ore from rich surface mines, especially in Australia and Brazil. Sweden's iron ore output was mostly exported to Western Europe, with the Federal Republic of Germany and Belgium-Luxembourg taking more than 50%. Although overall demand was down, demand for LKAB's high-grade pellets was up because ore-sintering capacity was shrinking in Europe. Production of LKAB's lump ore, all of the high-phosphorus variety, decreased because of decreased demand in Europe. LKAB production in 1987 was pellets, 53%; lump ore, 13%; and fines, 34%.

Manganese.—Manganese-rich nodules were discovered by Luleå University of Technology at water depths of 200 to 350 feet in the Gulf of Bothnia between Luleå and Vaasa, Finland. Large areas, up to 70 square miles, containing approximately 40,000 tons of nodules per square mile, were identified. Estimated reserves exceeded 1 million tons of manganese at a concentration of about 13%. The Swedish steel industry was dependent on imports for its manganese requirements.

Molybdenum.—Metallurg Inc., based in New York, sold its Ferrolegeringar Trollhättenverken AB plant in Trollhättan to Swedish steelmaker Sandvik AB. The plant, consisting of a 2,000-ton-per-year-Mo-content molybdenum oxide roaster and a grinding facility, employed 50 people. It was operating at full capacity using imported

raw material. Sandvik planned to use most of the product in its specialty steel manufacturing. The major feature of the plant, a 35,000-ton-per-year ferrochrome smelter, had closed in 1986.

Steel.—SSAB, mainly state-owned, produced about 80% of Sweden's rolled steel tonnage and was essentially the only producer of carbon steel. The major source of its iron ore was LKAB. Metallurgical coke was made by SSAB from imported coal, mostly from the United States. The Government sold some of the company's shares during 1987 to financial institutions. The company reorganized at yearend to help ensure a consistent future profit. Restructuring, begun immediately, included closing facilities that produced unprofitable products such as reinforcing bars. The company planned to emphasize steel sheet production and concentrate on the domestic market.

The SSAB was to have most of its operations at three major facilities, the Luleå steelworks in the far north near the LKAB iron mines, the Oxelösund steelworks 30 miles south of Stockholm, and the Domnarvet steel sheet-rolling plant 60 miles northwest of Stockholm. Rolling mills were also located at Luleå and Oxelösund. The company's new business organization consisted of three product divisions. The largest, SSAB Strip Products with 60% of total volume, consisted of a 700,000-ton-per-year coking plant and a 1.6-million-ton-per-year blast furnace smelter at Luleå, and a temporary electric arc furnace based on scrap at Domnarvet. Strip Products also had the Domnarvet sheet-rolling complex, which included a 2-million-ton-per-year wide-strip hot mill, a 900-million-ton-per-year cold-rolling mill, and lines for application of metal and plastic coatings to the sheet. SSAB Oxelösund, with 25% of total product capacity, consisted of a 450,000-ton-per-year coking plant, a 1.2-million-ton-per-year blast furnace smelter with systems for continuous casting of slab, and a hot-rolling mill, mainly for production of heavy plate, the unit's major product. SSAB Profiles, the third unit, was responsible for 15% of SSAB's total product capacity. Products were to be mostly heavy rolled sections made at Luleå and rails produced at Domnarvet.

SSAB closed or began shutting down outdated facilities during 1987, including a billet machine and a rolling mill at Luleå and a strip mill at Domnarvet and Surahammer. Decisions were made at yearend to invest in a second continuous-slab casting machine at Luleå and sheet-roll changing equipment and a second heat-treating furnace at Domnarvet at a cost of $100 million. The electric arc furnace at Domnarvet was to be closed when the second slab casting machine at Luleå became operational. Manufacturing of reinforcing bars, wire rod, and light-gauge long products was discontinued at yearend.

The larger blast furnace at Luleå suffered extensive damage early in the year, causing a production loss of 100,000 tons of steel. Production disturbances in the coking plant at Luleå necessitated a 15% use of imported coke. Extensive repairs were begun at Luleå. These costs were charged to the 1987 account. The company's 1987 profit after depreciation, $100 million, was aided by the transfer of the Grängesberg iron mine to the Government. Raw materials were less costly during the year because of the declining dollar and keen world competition.

Sweden's major specialty steel producers all reported improved results in 1987. Ovako Steel AB, the large new Finnish-Swedish specialty steel company, announced a 25% increase in annual raw steel capacity in its Hofors Tube Works, to 400,000 tons per year over the following 2 years. The company also invested $47 million in new finishing equipment at its Hällefors Works, raising annual bright bar capacity to 50,000 tons. Billet production at Hällefors was scheduled to terminate in 1989 upon shutting down the electric arc furnace. Ovako's overall specialty steel capacity was expected to remain near 1 million tons per year after making these changes. The other major specialty steel producers were Avesta AB and Sandvik Steel AB. Fagersta Stainless AB, jointly owned by Avesta and Sandvik, announced that it intended to invest $20 million in updating its rolling mill, thereby increasing output and productivity. European demand for stainless steel increased significantly during the year.

The U.S. Department of Commerce found in February that Avesta Sandvik Tube AB, the Swedish producer of stainless steel tube and pipes, had been indirectly subsidized by the Swedish Government in past years. Consequently, Commerce asked for a 2.18% countervailing duty on imports of Swedish hollow stainless steel products. However, the case was thrown out in March by the U.S. International Trade Commission (ITC). U.S. producers again urged the ITC in

October to impose the duty. Meanwhile, the ITC had decided in May that ending import restraints on stainless steel bar and rod and on alloy tool steel would adversely affect U.S. industry. In July, the U.S. Government extended the restraints for another 3 years, including a 3% tariff that decreased by 1% each year. The Swedish Government continued to contest the restraints, both directly to the U.S. Government and in international trade forums.

Zinc.—SKF Plasma Technologies AB reported that its prototype arc-plasma process for recovery of zinc metal from carbon-steel-mill bag dust operated continuously at near capacity throughout most of 1987. The annual production rate from the unit at Lanskrona was approximately 11,000 tons of Prime Western grade zinc from 55,000 tons of dust. Many design changes occurred during the furnace's intermittent operation period from 1984 until yearend 1986, including the design and construction of a satisfactory zinc metal condenser. The plant was initially operated by Scan Dust AB, a subsidiary of former SKF Steel Engineering AB. The bag dust was mixed with powdered coal and fluxes and fed, along with a carrier gas, into a 6-megawatt, water-cooled, coke-filled shaft furnace. Heat was supplied by arc-plasma generators placed symmetrically around the bottom of the furnace. The zinc vapor was absorbed in a spray of lead metal droplets in the condenser. Prime Western-grade zinc was subsequently separated in liquid form by cooling the molten lead-zinc alloy. The process met environmental standards, after a method was devised to recover small amounts of mercury vapor released during the reduction step. The process presented industry with a technically feasible and environmentally acceptable option for getting rid of baghouse dusts from steel plants. The dusts have been cited as an environmental problem.

INDUSTRIAL MINERALS

Nitrogen.—Supra AB, Sweden's only fertilizer manufacturer, closed its ammonia plant in Köping because of high production costs. The 25-year-old-plant's process was based on fuel oil feedstock. Supra AB was 75%-owned by Norsk Hydro A/S, the giant Norwegian fertilizer, oil, and aluminum producer.

Sulfur.—Boliden announced during the second half of the year that it would close by 1989 the smaller of two sulfuric acid plants and one of its two liquid SO_2 plants at its Ronnskar smelter as part of its program to reduce SO_2 emissions from the smelter by 50%. Total acid production would be affected miinimally but SO_2 production would be reduced significantly.

MINERAL FUELS

Closure of the nuclear power industry by the year 2010 continued to be the dominant energy policy in Sweden. A new energy bill presented to Parliament in May would close 2 of the 12 reactors during the mid-1990's. The first to be closed would be the Baresbäck reactor across the water from Copenhagen, Denmark. In addition, four large rivers were exempted from hydropower development, thereby eliminating an estimated 2,300 megawatts (MW). Nearly all of the 19,000 MW of Swedish electric power was generated by nuclear reactors, 50%, and hydropower, 46%. Most leaders of the minerals industry and much of its work force were opposed to the nuclear phaseout because the resultant higher cost of electric power would price mineral products out of the world markets, resulting in plant closures. Proponents of ending nuclear power argued in favor of strict conservation efforts, large imports of natural gas, and development of alternate domestic energy sources, many of them renewable. They said these remedies could, if applied rigorously, suffice to maintain a viable economy, albeit somewhat less robust. Energy conservation was to be promoted through improved thermal insulation, use of heat pumps in buildings, and energy-efficient lighting. Alternative domestic power sources included wood, wind, straw, peat, and industrial wastes. Coal-burning power stations were to be made more environmentally acceptable by applications such as the use of limestone in fluidized-bed combustion chambers. This technology was being incorporated into a new 400-MW station planned at Oxeläsund and two smaller 200-MW stations under construction in Stockholm.

Future importation of large volumes of natural gas from Norway and the U.S.S.R. was being emphasized as a viable option by yearend in view of methane's clean burning characteristics, its relatively low cost, and large reserves. Discussions began with both nations. A preliminary long-range preliminary plan was to construct a gas pipeline network throughout Sweden such that gas could be imported into the country without favoring any single exporting country. A direct pipeline from the undeveloped Hal-

tenbanken area of the Norwegian Sea would be very costly, requiring pipelaying through much rugged undersea and overland terrain in Norway and Sweden. A less expensive option was to tie Norwegian North Sea reserves to Danish North Sea pipelines already connected to Sweden, but this would expose the gas to potentially expensive Danish transport fees.

The 100-mile gas pipeline under construction in Sweden from Malmö to Göteborg for distribution of natural gas imported from Denmark reached Falkenberg by yearend, about 60% of the way. The Sweden-U.S.S.R. boundary line in the Baltic Sea was finally agreed upon after 18 years of negotiations. The Swedish Government began preparing for petroleum exploration in the Baltic east of Gotland.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Swedish kronor (SKr) to U.S. dollars at the rate of SKr6.33=US$1.00, the average for 1987.

The Mineral Industry of Switzerland

By Richard M. Levine[1]

In Switzerland, despite its rugged topography with abundant outcrops and plentiful small occurrences of minerals, exploration had not confirmed abundant economic mineral reserves. Switzerland had only a very small mining industry that exploited a few industrial minerals. All energy fuels were imported, except for about 1.1 billion cubic feet of natural gas produced at Fensterwald in Lucerne Canton. However, hydroelectric power was significant as an indigenous source of electric power. In the metallurgical sector, aluminum was the only metal produced in appreciable quantities.

In 1987, the Swiss economy continued its satisfactory course with the gross domestic product (GDP) growing at a rate of 2.5%. Major economic issues that Switzerland faced included coping with the growing coordination of economic ties with the countries of the European Communities (EC), of which Switzerland was not a member, and deciding whether to proceed with nuclear power development. Economic growth was accompanied by investment in heavy capital goods purchases and by a strong revival of the construction industry.

PRODUCTION

All mineral industries were privately owned except for the salt industry, which was a Government monopoly. Metallurgical products were produced entirely from imported raw materials. Although aluminum was the only metal produced in appreciable quantities, the country also produced small amounts of gallium, iron and steel products, and secondary lead. Switzerland refined its own petroleum products but relied entirely on imported crude stocks. The country also produced a small number of industrial minerals, including cement, gypsum, lime, nitrogen, salt, and sodium compounds.

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

(Thousand metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum, smelter, primary ____ metric tons__	75,974	79,173	72,742	80,249	[3]73,169
Iron and steel:					
Pig iron and blast furnace ferroalloys ____	10	54	66	79	80
Electric-furnace ferroalloys[e] ____	4	5	5	5	5
Steel, crude ____	835	978	987	1,075	1,100
Semimanufactures, rolled products ____	780	800	950	980	900
Lead, refined, secondary ____ metric tons__	2,000	2,000	2,000	2,500	2,500
INDUSTRIAL MINERALS					
Cement, hydraulic ____	4,138	4,181	4,254	4,393	[3]4,617
Gypsum[e] ____	186	220	220	200	230
Lime ____	42	41	37	35	40
Nitrogen: N content of ammonia ____	[r]35	[r]33	31	30	39
Salt ____	317	372	374	389	390
Sodium compounds, n.e.s.: Carbonate[e] metric tons__	45	44	45	43	23
Sulfur, byproduct, all sources ____ do____	2,711	2,878	2,638	3,201	3,533
MINERAL FUELS AND RELATED MATERIALS					
Gas:					
Manufactured ____ million cubic feet__	1,131	1,098	1,154	1,162	1,170
Natural ____ do____	--	--	700	600	1,100
Petroleum refinery products:					
Refinery gas thousand 42-gallon barrels__	948	849	920	984	1,070
Liquefied petroleum gas ____ do____	[r]1,636	[r]1,647	1,717	1,670	[3]1,817
Gasoline, all kinds ____ do____	[r]9,343	[r]8,407	8,486	8,723	[3]8,765
Naphtha ____ do____	162	77	77	153	160
Jet fuel ____ do____	[r]2,044	[r]2,052	1,922	2,099	[3]2,286
Kerosene ____ do____	37	[r]25	32	31	[3]30
Distillate fuel oil ____ do____	[r]13,243	[r]13,184	13,494	13,622	[3]12,862
Residual fuel oil ____ do____	[r]4,927	[r]5,081	4,746	4,824	[3]4,117
Bitumen ____ do____	689	844	695	926	[3]933
Total ____ do____	[r]32,867	[r]32,089	32,012	32,789	31,880

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

[1]Table includes data available through Nov. 30, 1988.

[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.

[3]Reported figure.

TRADE

Reflecting its lack of natural resources, Switzerland usually ran a merchandise-trade deficit that was more than compensated for by earnings on capital and services, which in total yielded a positive current account balance. In 1987, Switzerland was able to achieve an increase in exports despite the appreciation of the Swiss franc.[2] However, the trade balance was less favorable than in 1986 as imports increased more than exports. Switzerland ranked as the seventh-largest European trading partner of the United States, ranking behind Italy but ahead of Spain. Precious stones and jewelry were one of the main Swiss imports from the United States, and jewelry was one of the main Swiss exports to the United States. The United States placed Switzerland in a more favorable status as a recipient of items on the U.S. export control list, which eased the granting of U.S. export licenses.

Government Policies and Programs.—In 1987, the third stage of a phase-in of emission standards for automobiles was implemented, bringing emission standards to the levels of the United States 1983 standards. These new standards would implicitly necessitate catalytic converters. Also during the year, Switzerland and the EC reached a basic agreement on scientific and technological cooperation for research and development in advanced materials in an effort to coordinate the EC program with the Swiss research program "Materials for the Needs of Tomorrow."

Despite projected increases in electricity demand in the coming decades, two popular initiatives to amend the Constitution were advanced opposing nuclear power development. One would impose a 10-year moratorium on construction of new nuclear powerplants, and the other called for a complete phaseout of nuclear power. These two national referenda were to be voted upon in 1990-91. Recent opposition to nuclear power development had been fueled by the accident at the reactor in Chernobyl in

the U.S.S.R.

Switzerland already had five nuclear powerplants in operation that supplied almost 40% of the country's electric power output with this percentage rising in winter. Nuclear power had tripled its share of energy generation in the past 15 years. During the year, a study was being conducted by a group of experts commissioned by the Swiss Federal Energy Office to determine the prerequisites, possibilities, and consequences of phasing out the use of nuclear energy in Switzerland. Results of this study were to be released in 1988.

Owing to the increased opposition to the development of nuclear power in the country, plans for the construction of the nuclear powerplant at Kaiseraugst near Basel, over which a 20-year battle had been waged, were in serious jeopardy of being canceled.

Table 2.—Switzerland: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals ____ kilograms	2,604	2,358	64	West Germany 638.
Alkaline-earth metals ____ do ____	98	35	--	NA.
Aluminum:				
Ore and concentrate ____	10	14	NA	NA.
Oxides and hydroxides ____	1,445	423	36	West Germany 215.
Metal including alloys:				
Unwrought including scrap ____	49,570	54,582	32	West Germany 32,756; Italy 16,028.
Semimanufactures ____	101,668	104,870	2,806	West Germany 23,646; France 17,436.
Antimony: Metal including alloys, all forms ____ kilograms	172	1,292	NA	NA.
Arsenic: Oxides and acids ____ do ____	148	103	NA	NA.
Beryllium: Metal including alloys, all forms ____ do ____	159	164	14	NA.
Chromium: Oxides and hydroxides ____	75	28	(2)	West Germany 19; Italy 3.
Cobalt: Oxides and hydroxides kilograms	205	363	--	NA.
Columbium and tantalum: Metal including alloys, all forms, tantalum do ____	794	550	25	West Germany 161; United Kingdom 161.
Copper:				
Ore and concentrate ____	(2)	--		
Matte and speiss including cement copper ____	2,593	60	(2)	Italy 26; West Germany 24.
Sulfate ____	25	12	NA	West Germany 4.
Metal including alloys:				
Scrap ____	13,268	12,244	98	West Germany 5,814; Austria 2,190; Italy 1,299.
Unwrought ____	5,790	5,310	--	West Germany 3,699; Italy 1,467.
Semimanufactures ____	25,730	26,776	3,973	West Germany 9,972; France 3,215.
Gold: Metal including alloys, unwrought and partly wrought thousand troy ounces	29,897	29,640	NA	NA.
Iron and steel:				
Iron ore and concentrate: Pyrite, roasted ____	28	29	--	France 8; Peru 8; Philippines 6.
Metal:				
Scrap ____	100,135	60,949	--	Italy 39,668; West Germany 15,744.
Pig iron, cast iron, related materials ____	829	1,030	27	West Germany 848.
Ferroalloys:				
Ferroaluminum ____	2	2	--	All to West Germany.
Ferrosilicon ____	115	133	--	West Germany 65.
Silicon metal ____	6,445	6,195	34	West Germany 5,665; Austria 240; Italy 202.
Unspecified ____	199	156	1	West Germany 34.
Steel, primary forms ____	6,721	26,152	--	Italy 23,530; France 2,126.
Semimanufactures:				
Bars, rods, angles, shapes, sections ____	535,213	505,438	588	West Germany 277,860; Italy 115,783; France 46,774.
Universals, plates, sheets --	96,012	110,852	1,235	West Germany 82,724; Austria 7,906; Italy 5,945.

See footnotes at end of table.

Table 2.—Switzerland: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures —Continued				
Hoop and strip	35,196	46,129	53	Austria 19,585; West Germany 16,365; France 7,272.
Rails and accessories	3,354	2,180	18	Italy 837; Austria 647; West Germany 358.
Wire	25,369	26,863	2,448	West Germany 14,327; France 4,308.
Tubes, pipes, fittings	210,029	189,610	9,240	West Germany 77,352; Denmark 17,579.
Castings and forgings, rough	10,269	11,148	424	West Germany 4,520; France 3,040.
Lead:				
Oxides	5	128	--	U.S.S.R. 120; Uganda 4; Austria 2.
Metal including alloys:				
Scrap	10,391	16,008	--	Italy 9,327.
Unwrought	4,983	2,088	--	Italy 1,521.
Semimanufactures	44	13	(2)	West Germany 6; Austria 3.
Magnesium: Metal including alloys:				
Unwrought including scrap	202	116	--	West Germany 96.
Semimanufactures	584	649	28	France 188; Belgium-Luxembourg 75.
Manganese: Oxides	146	4	--	Greece 3.
Mercury 76-pound flasks	854	151	(2)	Netherlands 58; Bulgaria 29; West Germany 29.
Molybdenum: Metal including alloys, all forms	12	6	(2)	West Germany 2; Brazil 1.
Nickel: Metal including alloys:				
Scrap	256	295	--	West Germany 276; France 19.
Unwrought	105	44	(2)	West Germany 43.
Semimanufactures	563	546	2	France 219; West Germany 138; Italy 63.
Platinum-group metals: Metals including alloys, unwrought and partly wrought thousand troy ounces	999	915	21	Japan 304; West Germany 166.
Rare-earth metals including alloys, all forms kilograms	72	751	--	Japan 250.
Silver:				
Waste and sweepings[3] value, thousands	$154,916	$67,878	$7	West Germany $28,166; Spain $23,978.
Metal including alloys, unwrought and partly wrought thousand troy ounces	17,485	22,107	37	United Kingdom 933.
Tin: Metal including alloys:				
Scrap	90	28	--	West Germany 13.
Unwrought	198	161	(2)	Italy 70; West Germany 66.
Semimanufactures	24	59	--	Iran 34; Italy 8.
Titanium: Oxides	397	139	(2)	Austria 50; Italy 49.
Tungsten: Metal including alloys, all forms	63	38	(2)	West Germany 31.
Uranium and thorium: Oxides and other compounds	7	5	(2)	West Germany 2.
Zinc:				
Oxides	22	18	--	Italy 12; Yugoslavia 3; France 2.
Blue powder	25	34	NA	Austria 15; Hungary 10.
Metal including alloys:				
Scrap	1,182	1,222	--	Italy 750; West Germany 389.
Unwrought	137	27	--	West Germany 19; Italy 5; France 2.
Semimanufactures	79	11	--	France 3; West Germany 2.
Other:				
Ores and concentrates	105	178	(2)	Portugal 65; West Germany 32; Italy 25.
Ashes and residues	15,485	16,518	38	West Germany 6,350; Belgium-Luxembourg 4,966; Italy 2,066.
Base metals including alloys, all forms	302	978	62	West Germany 109.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	28	25	(2)	West Germany 7; France 1.
Artificial:				
Corundum	271	220	17	West Germany 131.
Silicon carbide	5,504	5,622	NA	NA.

See footnotes at end of table.

Table 2.—Switzerland: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Abrasives, n.e.s. —Continued				
Dust and powder of precious and semiprecious stones including diamond kilograms	3,369	3,674	198	Italy 1,502; France 402; West Germany 380.
Grinding and polishing wheels and stones	1,912	1,830	42	West Germany 453; United Kingdom 427.
Asbestos, crude	5	15	(2)	Austria 7; West Germany 5.
Barite and witherite	38	15	1	Ivory Coast 5; West Germany 4; Austria 3.
Boron materials:				
Crude natural borates	5	3	--	All to West Germany.
Oxides and acids	5	2	--	NA.
Cement	16,575	25,288	54	West Germany 23,392; France 1,695.
Chalk	280	284	20	West Germany 184; France 26; Austria 15.
Clays, crude	50,513	73,080	(2)	West Germany 72,775; Austria 145.
Cryolite and chiolite	46	5	--	Brazil 2; Turkey 1; Venezuela 1.
Diamond:				
Gem, not set or strung value, thousands	$1,002,872	$1,324,543	$62,731	United Kingdom $746,443; Israel $249,461.
Industrial stones do.	$39,771	$45,856	$1,364	Italy $21,212; France $4,157; West Germany $3,519.
Diatomite and other infusorial earth	40	50	(2)	Yugoslavia 24; Greece 8; West Germany 4.
Feldspar, fluorspar, related materials	159	153	--	Portugal 41; West Germany 39; Venezuela 24.
Fertilizer materials:				
Crude, n.e.s	2,210	1,871	--	Austria 1,245; France 543.
Manufactured:				
Ammonia	31	11	--	France 6; West Germany 2; Republic of Korea 1.
Nitrogenous	1,953	1,346	2	West Germany 1,220; Sweden 80.
Phosphatic	2	4	NA	NA.
Unspecified and mixed	3,535	4,284	14	West Germany 2,104; Peru 612.
Graphite, natural	10	8	--	West Germany 2; Republic of Korea 2; Peru 1.
Gypsum and plaster	11,970	15,143	1	France 15,014.
Lime	787	768	--	Norway 322; West Germany 203; Denmark 175.
Magnesium compounds: Oxides and hydroxides	16	75	(2)	West Germany 20; France 6.
Mica:				
Crude including splittings and waste	130	77	--	West Germany 57; Venezuela 8; Austria 5.
Worked including agglomerated splittings	447	490	1	Sweden 63; United Kingdom 51; Norway 50.
Phosphates, crude kilograms	--	84	--	All to West Germany.
Phosphorus, elemental do.	222	791	NA	West Germany 44; unspecified 747.
Pigments, mineral:				
Natural, crude	29	28	NA	NA.
Iron oxides and hydroxides, processed	78	405	1	West Germany 353; Philippines 15.
Potassium salts, crude	103	117	NA	NA.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$168,344	$193,226	$31,966	France $36,098; Hong Kong $23,136.
Synthetic do.	$20,003	$27,763	$4,507	West Germany $4,825; France $2,651.
Pyrite, unroasted	16,853	--		
Salt and brine	49	45	(2)	Argentina 9; Bangladesh 9; Belgium-Luxembourg 6.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	22,532	15,739	NA	Italy 10,253; West Germany 5,186.
Sulfate, manufactured	178	46	NA	Austria 15.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	21,978	27,153	(2)	West Germany 12,757; Italy 12,692.
Worked	8,319	7,593	8	West Germany 6,710; Austria 404.
Dolomite, chiefly refractory-grade	38	24	--	West Germany 18; Philippines 5.

See footnotes at end of table.

Table 2.—Switzerland: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel —Continued				
Gravel and crushed rock	8,972	43,853	1	West Germany 41,716; France 963.
Limestone other than dimension	25	80	--	France 78.
Quartz and quartzite	30,777	36,069	1	Italy 35,217; West Germany 607.
Sand other than metal-bearing	16,837	18,955	(2)	Italy 14,971; France 2,975.
Sulfur:				
Elemental:				
Crude including native and by-product	4,634	6,421	--	Italy 3,570; Yugoslavia 1,483; West Germany 1,276.
Colloidal, precipitated, sublimed	27	43	--	West Germany 42.
Dioxide	9	15	--	NA.
Sulfuric acid	20,209	18,438	(2)	West Germany 15,754; France 1,216.
Talc, steatite, soapstone, pyrophyllite	95	86	(2)	Austria 48; France 10; West Germany 8.
Other:				
Crude	3,917	1,762	(2)	West Germany 1,309; Belgium-Luxembourg 74.
Slag and dross, not metal-bearing	36,051	44,699	--	West Germany 32,355; Italy 11,496.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	3	34	--	France 32; West Germany 2.
Carbon black	253	183	(2)	Czechoslovakia 57; Austria 30; West Germany 24.
Coal:				
Anthracite and bituminous	2,204	1	NA	NA.
Briquets of anthracite and bituminous coal kilograms	--	105	--	All to Brazil.
Coke and semicoke	257	1,686	--	West Germany 1,685.
Peat including briquets and litter	1,522	1,212	--	Austria 1,056; West Germany 156.
Petroleum:				
Crude 42-gallon barrels	7	43	--	U.S.S.R. 36.
Refinery products:				
Liquefied petroleum gas do	489,694	330,600	1,427	Italy 283,933; France 33,489.
Gasoline do	145,852	34,162	17	Austria 32,198; Netherlands 986.
Mineral jelly and wax do	776	1,015	228	France 244; United Kingdom 228.
Kerosene and jet fuel do	2,464	2,992	--	Austria 2,836; West Germany 85.
Distillate fuel oil do	110,020	34,987	--	Austria 34,972.
Lubricants do	126,084	104,972	6,573	Italy 24,724; West Germany 24,045.
Residual fuel oil do	1,938,007	1,252,246	--	West Germany 1,134,012; Austria 99,787.
Bitumen and other residues do	18	2,333	--	All to Austria.
Bituminous mixtures do	11,684	12,447	1,097	West Germany 3,109; France 2,188.
Petroleum coke do	390	412	33	West Germany 280; Italy 88.

NA Not available.
[1]Table prepared by Linda Williams.
[2]Less than 1/2 unit.
[3]May include other precious metals.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	519	392	1	West Germany 350; United Kingdom 30; France 10.
Alkaline-earth metals kilograms	519	1,357	251	NA.
Aluminum:				
Ore and concentrate	44	512	--	West Germany 132; United Kingdom 101.
Oxides and hydroxides	146,751	160,374	112	Australia 125,419; Italy 23,347.
Metal including alloys:				
Unwrought including scrap	78,745	88,274	67	West Germany 30,029; Norway 22,232; Iceland 21,406.
Semimanufactures	62,106	65,767	387	West Germany 29,572; Belgium-Luxembourg 10,680.
Antimony: Metal including alloys, all forms	27	62	NA	China 55.
Arsenic: Oxides and acids	31	1	--	NA.
Beryllium: Metal including alloys, all forms kilograms	1,019	3,532	2,663	United Kingdom 450; West Germany 419.
Chromium: Oxides and hydroxides	788	794	54	West Germany 571; Poland 79.
Cobalt: Oxides and hydroxides	2	15	1	West Germany 12; United Kingdom 1.
Columbium and tantalum: Metal including alloys, all forms, tantalum kilograms	1,457	2,024	1,007	Austria 830.
Copper:				
Ore and concentrate do	25	25	--	All from West Germany.
Matte and speiss including cement copper	11,637	13,707	167	Belgium-Luxembourg 3,812; West Germany 3,776; Chile 3,411.
Sulfate	802	738	--	Italy 260; U.S.S.R. 190; Czechoslovakia 90.
Metal including alloys:				
Scrap	6,845	6,263	428	West Germany 2,535; U.S.S.R. 1,678; Austria 525.
Unwrought	1,403	1,512	4	West Germany 1,035; United Kingdom 218.
Semimanufactures	89,100	89,848	395	West Germany 33,745; United Kingdom 16,950; France 11,894.
Gold: Metal including alloys, unwrought and partly wrought thousand troy ounces	28,392	38,420	NA	France 55; unspecified 38,286.
Iron and steel:				
Iron ore and concentrate: Pyrite, roasted	6,418	11,240	--	Belgium-Luxembourg 7,754; Norway 2,882; Italy 463.
Metal:				
Scrap	239,934	323,815	--	West Germany 195,443; France 105,107; Netherlands 17,453.
Pig iron, cast iron, related materials	70,402	50,976	3	West Germany 22,706; France 9,695; Brazil 9,509.
Ferroalloys:				
Ferroaluminum	301	377	--	United Kingdom 194; Belgium-Luxembourg 97.
Ferrosilicon	7,219	7,963	--	U.S.S.R. 2,319; West Germany 2,259; Yugoslavia 1,194.
Silicon metal	264	256	36	West Germany 123; France 72.
Unspecified	15,003	15,156	(2)	Norway 5,728; West Germany 3,620; France 3,199.
Steel, primary forms	208,572	164,303	77	West Germany 44,127; Netherlands 34,055; United Kingdom 31,933.
Semimanufactures:				
Bars, rods, angles, shapes, sections	638,396	660,236	603	Italy 183,288; West Germany 162,017; Belgium-Luxembourg 128,255.
Universals, plates, sheets	703,501	772,387	69	West Germany 201,932; Belgium-Luxembourg 126,504.
Hoop and strip	238,318	243,496	800	West Germany 131,730; Netherlands 36,438; Austria 27,670.
Rails and accessories	41,748	45,851	(2)	Austria 24,924; West Germany 14,291; Italy 5,374.
Wire	41,945	48,473	39	West Germany 15,349; Italy 12,897; Belgium-Luxembourg 4,823.
Tubes, pipes, fittings	153,737	152,483	109	West Germany 68,177; Italy 23,222; France 15,876.
Castings and forgings, rough	14,622	14,970	45	West Germany 5,132; East Germany 3,635; France 1,833.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Lead:				
Ore and concentrate	3	12	12	
Oxides	265	402	--	West Germany 351; France 32; Netherlands 10.
Metal including alloys:				
Scrap	2	303	NA	Netherlands 286.
Unwrought	10,681	10,186	1,047	France 2,757; Canada 2,035; West Germany 1,701.
Semimanufactures	1,721	1,758	1	West Germany 1,533; Belgium-Luxembourg 187.
Magnesium: Metal including alloys:				
Unwrought including scrap	2,119	2,556	142	Norway 1,542; Italy 374; Canada 320.
Semimanufactures	56	41	3	West Germany 27; Italy 5.
Manganese: Oxides	1,118	1,434	(2)	Greece 894; Japan 298; Belgium-Luxembourg 101.
Mercury 76-pound flasks	1,705	1,084	(2)	Spain 565; United Kingdom 162.
Molybdenum: Metal including alloys, all forms	23	21	2	Austria 10; West Germany 5.
Nickel:				
Ore and concentrate	--	56	(2)	U.S.S.R. 24; Norway 21; United Kingdom 11.
Metal including alloys:				
Scrap	86	29	(2)	West Germany 14; Ivory Coast 5; Bulgaria 4.
Unwrought including matte and speiss	1,261	1,382	25	Republic of South Africa 297; Norway 242; Finland 225.
Semimanufactures	1,565	1,524	78	West Germany 914; United Kingdom 254.
Platinum-group metals: Metals including alloys, unwrought and partly wrought thousand troy ounces	1,198	1,158	112	United Kingdom 420; U.S.S.R. 158; West Germany 149.
Rare-earth metals including alloys, all forms kilograms	4,778	611	133	France 158.
Silver:				
Waste and sweepings[3] value, thousands	$67,655	$47,036	$1,537	Saudi Arabia $5,661; Lebanon $5,487; West Germany $4,762.
Metal including alloys, unwrought and partly wrought thousand troy ounces	29,047	56,225	22	Peru 808; West Germany 112; unspecified 52,997.
Tin:				
Ore and concentrate kilograms	235	--		
Metal including alloys:				
Scrap	7	5	--	Mainly from West Germany.
Unwrought	977	1,369	20	Malaysia 616; Indonesia 125; Netherlands 123.
Semimanufactures	407	432	2	West Germany 268; Belgium-Luxembourg 67; Netherlands 63.
Titanium: Oxides	2,348	1,693	(2)	West Germany 738; Belgium-Luxembourg 323; United Kingdom 302.
Tungsten: Metal including alloys, all forms	98	64	8	France 20; West Germany 18.
Uranium and thorium: Oxides and other compounds	16	18	1	France 11; West Germany 3.
Zinc:				
Ore and concentrate	4	4	--	All from West Germany.
Oxides	1,432	1,221	(2)	France 517; West Germany 290; United Kingdom 211.
Blue powder	3,352	3,500	--	Belgium-Luxembourg 1,890; West Germany 1,030.
Metal including alloys:				
Scrap	24	141	NA	Belgium-Luxembourg 49; Italy 33.
Unwrought	26,363	30,186	1	Netherlands 7,856; West Germany 6,562; Norway 5,191.
Semimanufactures	1,536	1,640	21	West Germany 757; France 277; Belgium-Luxembourg 264.
Other:				
Ores and concentrates	4,442	3,459	306	West Germany 900; Belgium-Luxembourg 853; Republic of South Africa 448.
Ashes and residues	807	1,172	1	West Germany 906; Austria 152.
Base metals including alloys, all forms	1,204	1,361	230	Republic of South Africa 234; Belgium-Luxembourg 230.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	9,462	10,571	129	West Germany 9,929; Italy 471.
Artificial:				
Corundum	7,077	7,006	250	West Germany 3,116; Austria 2,374.
Silicon carbide	4,017	1,441	(2)	West Germany 1,145; Norway 249; U.S.S.R. 30.
Dust and powder of precious and semi-precious stones including diamond kilograms	5,671	5,967	1,154	Ireland 4,002.
Grinding and polishing wheels and stones	2,171	2,065	22	West Germany 1,003; Italy 335; Austria 211.
Asbestos, crude	5,058	3,923	7	U.S.S.R. 1,422; Canada 1,408; Republic of South Africa 888.
Barite and witherite	1,348	885	--	West Germany 676; France 141; Italy 60.
Boron materials:				
Crude natural borates	302	200	--	Netherlands 172; Turkey 26.
Oxides and acids	402	468	1	France 165; Turkey 133; Italy 110.
Cement	350,964	425,052	16	West Germany 165,732; Italy 152,089; France 58,366.
Chalk	38,431	40,357	26	France 30,623; Italy 7,913; West Germany 1,492.
Clays, crude	179,468	171,002	1,309	United Kingdom 73,128; West Germany 72,874; France 14,456.
Cryolite and chiolite	35	16	--	Denmark 15.
Diamond:				
Gem, not set or strung value, thousands	$1,036,659	$1,480,503	$111,041	United Kingdom $1,098,280; Belgium-Luxembourg $67,365.
Industrial stones do	$38,951	$45,587	$4,694	Ireland $36,307; West Germany $2,629.
Diatomite and other infusorial earth	6,920	6,303	123	Denmark 4,777; France 913.
Feldspar, fluorspar, related materials	17,301	11,691	--	Italy 5,209; West Germany 2,960; France 2,163.
Fertilizer materials:				
Crude, n.e.s	17,649	14,736	1	France 9,151; Italy 3,349; West Germany 1,596.
Manufactured:				
Ammonia	22,306	28,870	--	Austria 10,535; France 9,191; West Germany 7,246.
Nitrogenous	94,564	98,083	18	Austria 33,166; West Germany 14,635; Netherlands 13,557.
Phosphatic	92,105	85,663	--	France 58,216; Belgium-Luxembourg 23,436; Netherlands 2,327.
Unspecified and mixed	164,647	169,233	14,268	France 46,131; West Germany 42,738; Belgium-Luxembourg 25,948.
Graphite, natural	108	237	(2)	West Germany 110; Italy 72; France 27.
Gypsum and plaster	70,096	69,208	--	West Germany 46,488; Italy 15,735; France 6,145.
Lime	71,824	75,295	--	West Germany 41,857; Italy 33,375.
Magnesium compounds:				
Magnesite, crude	12	24	--	NA.
Oxides and hydroxides	5,383	5,425	25	Austria 3,006; Spain 1,333.
Meerschaum, amber, jet kilograms	1	--		
Mica:				
Crude including splittings and waste	611	585	1	France 257; West Germany 159; United Kingdom 71.
Worked including agglomerated splittings	388	431	1	France 240; Belgium-Luxembourg 99; India 75.
Nitrates, crude	14	--		
Phosphates, crude	6,247	9,837	--	France 5,193; Morocco 3,977; Israel 510.
Phosphorus, elemental	4,419	4,112	83	France 1,088; Italy 1,077.
Pigments, mineral:				
Natural, crude	309	244	--	Austria 135; West Germany 77.
Iron oxides and hydroxides, processed	3,387	2,388	19	West Germany 2,107; United Kingdom 74; Japan 39.
Potassium salts, crude	81,381	71,002	--	France 48,558; West Germany 4,794.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Precious and semiprecious stones other than diamond:				
Natural ____ value, thousands__	$210,450	$255,212	$61,050	United Kingdom $32,763; Hong Kong $29,722.
Synthetic ____ do____	$8,902	$12,130	$1,77	France $5,866; West Germany $1,401.
Pyrite, unroasted	84	131	--	West Germany 68; France 58; Italy 5.
Salt and brine	1,932	2,226	(2)	France 1,908; West Germany 198.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	5,968	4,650	(2)	East Germany 2,362; West Germany 1,958.
Sulfate, manufactured	19,166	21,527	--	West Germany 10,793; Austria 9,850.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked ____	110,346	169,743	--	West Germany 70,981; Austria 40,663; France 30,647.
Worked	125,452	149,519	15	Italy 104,194; Portugal 19,787.
Dolomite, chiefly refractory-grade __	22,410	22,885	16	Italy 11,671; West Germany 5,968; Belgium-Luxembourg 2,993.
Gravel and crushed rock	5,785,180	6,119,100	129	France 3,325,881; West Germany 1,647,340; Italy 718,732.
Limestone other than dimension ___	12,805	6,829	--	France 6,446; Italy 329; West Germany 54.
Quartz and quartzite	35,636	28,605	444	Italy 13,326; West Germany 7,952; Portugal 6,229.
Sand other than metal-bearing ____	1,506,443	1,693,513	21	Italy 625,114; West Germany 477,586; France 463,970.
Sulfur:				
Elemental:				
Crude including native and by-product	48,577	47,320	--	West Germany 47,274.
Colloidal, precipitated, sublimed	206	119	(2)	West Germany 74; France 40.
Dioxide	39	38	NA	Italy 29; France 6.
Sulfuric acid	2,846	1,609	(2)	West Germany 1,351; Austria 52; France 47.
Talc, steatite, soapstone, pyrophyllite __	13,421	14,922	3	Austria 10,082; Italy 2,128; France 1,197.
Other:				
Crude	117,215	129,554	998	West Germany 71,075; Spain 23,528; France 10,577.
Slag and dross, not metal-bearing ___	34,998	37,304	--	West Germany 26,610; France 9,487.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,268	1,944	53	Trinidad and Tobago 983; France 519; West Germany 383.
Carbon:				
Carbon black	5,048	5,189	92	West Germany 3,372; France 1,252.
Gas carbon	277	423	--	All from West Germany.
Coal:				
Anthracite and bituminous	473,541	613,799	134,406	Republic of South Africa 251,862; West Germany 77,741; Australia 54,702.
Briquets of anthracite and bituminous coal	12,473	12,327	--	West Germany 11,245; Belgium-Luxembourg 854.
Lignite including briquets	32,846	23,235	--	West Germany 21,695; East Germany 1,467.
Coke and semicoke	78,260	68,235	2,259	West Germany 41,449; France 15,707; Netherlands 5,545.
Peat including briquets and litter	61,945	64,272	--	West Germany 58,341; U.S.S.R. 5,403.
Petroleum:				
Crude thousand 42-gallon barrels__	28,744	28,763	--	Libya 12,466; Nigeria 5,388; Algeria 3,938.
Refinery products:				
Liquefied petroleum gas do____	12,901	11,236	(2)	Netherlands 7,177; West Germany 4,001.
Gasoline ____ do____	18,109	20,117	74	Belgium-Luxembourg 6,351; West Germany 4,085.
Mineral jelly and wax __ do____	108	116	1	West Germany 56; France 26.
Kerosene and jet fuel__ do____	656	641	(2)	Netherlands 195; Belgium-Luxembourg 147; Italy 136.
Distillate fuel oil ____ do____	36,902	45,074	81	U.S.S.R. 12,971; Netherlands 9,896.
Lubricants ____ do____	591	602	8	West Germany 170; Italy 122; Netherlands 104.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products —Continued				
Residual fuel oil thousand 42-gallon barrels	1,485	388	--	West Germany 208; Netherlands 78.
Bitumen and other residues do	1,023	948	--	West Germany 667; Italy 191.
Bituminous mixtures do	63	80	1	West Germany 50; France 18.
Petroleum coke do	364	436	206	West Germany 227.

NA Not available.
[1]Table prepared by Linda Williams.
[2]Less than 1/2 unit.
[3]May include other precious metals.

COMMODITY REVIEW

METALS

Aluminum.—The Swiss aluminum and chemicals group, Alusuisse S.A., showed a profit in 1987 following a net loss in 1986. The aluminum and chemical divisions made operating profits in 1987. Alusuisse was in the middle of a major 3-year rationalization program that called for reducing its primary aluminum smelting capacity with all smelting in the future to be done at its European facilities. Plans called for reducing primary smelting capacity in 1988 to between 250,000 to 300,000 tons per year after having reduced primary smelting capacity in 1986 by 50% from 800,000 to 400,000 tons per year.

In the United States, changes in Alusuisse operations included the sale of the Ormet smelter, the Burnside alumina works, and the Madison extrusion works and the shutdown of the New Johnsonville smelter. Also, plans called for Alusuisse to close the Chippis smelter in Switzerland and to reduce production at its Rheinfelden smelter in the Federal Republic of Germany to 40,000 tons per year.

These moves would make it necessary for Alusuisse to buy 30% to 40% of its metal from outside; the company had already started the process of evaluating sources of billet and slab. The highest quality metal was to be produced in-house, with the brought-in metal used for the less exacting product lines.

Although Alusuisse had sold part of its share in Sor-Norge Aluminium A/S in Norway and was negotiating the sale of one-half of its share in Sava-Alumino Veneto in Italy, it did not plan to completely eliminate its European smelting capacity. Alusuisse planned to reduce its emphasis on primary metal and to sell part of its alumina and bauxite operations.

Future development at Alusuisse envisioned continuing development of downstream products with high-quality, value-added products as its target. Alusuisse planned to particularly concentrate on packaging, and also to concentrate on extrusions for the transport sector, on lithographic sheet, and on casting alloys. Alusuisse was already an international supplier of wide extrusions to railroad coach builders, and in the extrusion sector, plans called for increasing throughput of hard alloys and moving away from more general application soft alloys.

One of the major plants where Alusuisse planned to produce higher quality products was its Singen plant in the Federal Republic of Germany. The plant contained an array of rolling, extruding, lacquering, and foil converting equipment, including an extrusion press capable of producing 800-millimeter extrusions, which were the widest produced in Europe. Owing to its high-quality output, Alusuisse planned to market products from Singen in Europe and North America.

Gallium.—Alcan Aluminum Ltd., which operated a 10-ton-per-year gallium plant at Rorschach that it purchased from Alusuisse in 1985, was producing gallium from 99.9999% (6N) to 99.999999% (8N) purity using 99.9% (3N) to 99.99% (4N) pure gal-

lium recovered from scrap feed material from the company's plant in Canada. In recent years, most of Switzerland's gallium production was exported to the United States with a small quantity exported to Japan.

Alcan was testing a pilot gallium extraction plant at its Jonquire, Quebec, Canada, aluminum smelter in an effort to get a 4-ton-per-year extraction unit on-stream to produce comparatively low-grade 4N metal for shipment to Rorschach for refining into 99.99999% (7N) and 8N gallium metal. Ultimate capacity at the Jonquire plant was envisioned at 15 tons per year.

Also, regarding new gallium production facilities, Sulzer, the Swiss engineering firm, was constructing a pilot gallium extraction plant at Kaiser Aluminum's Gramercy, Louisiana, alumina refinery.

Gold.—Exploration of the Disentis Prospect in Graubunden Canton, continued. Approximately 1,200 meters of holes had been drilled, and electromagnetic and magnetic surveys were conducted by helicopter. Reportedly, detailed geological mapping and prospecting of geological anomalies had occurred. Previous sampling of the area yielded grab samples assaying in a range from 11 meters deep at 2.4 grams per ton to 0.33 meter deep at 8.6 grams per ton.

Iron and Steel.—The Swiss steelmaker, Von Roll Ltd., reported its profits rose 31% in 1987 despite a 1% decrease in turnover. Von Roll was helped by a strong demand for reinforcing bar (rebars) from the construction industry. Nevertheless, Von Roll planned to reduce steel capacity by 100,000 tons per year at its Gerlafinger and Monteforno works.

INDUSTRIAL MINERALS

The building trades traditionally occupied a strong place in the Swiss economy. Building and construction accounted for more than 15% of the gross national product (GNP), ranking Switzerland second only to Japan in the share of the GNP accounted for by this sector among advanced industrial nations.

Cement.—In 1987, portland cement production increased 5% over 1986. Almost 59% of the cement consumed went into the ready-mixed concrete industry, 16% went to the building trades, 10% went to concrete products manufacturers, and the remainder to miscellaneous uses. Plans called for commissioning the first desulfurization plant in the Swiss cement industry during the first half of 1988 with Switzerland's Holderbank Management and Consulting Ltd. installing the data handling system.

Sodium Compounds.—The Swiss plant, La Soudiere Swisse, a subsidiary of Belgium's Salvay and Cie. S.A., ceased production of sodium carbonate in mid-1987. The plant had a capacity of about 50,000 tons per year of sodium carbonate.

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[1]Foreign mineral specialist, Division of International Minerals.

[2]Where necessary values have been converted from Swiss francs (SWF) to U.S. dollars at the rate of SWF1.49=US$1.00.

The Mineral Industry of Taiwan

By E. Chin[1]

Taiwan is an island with limited resources of minerals and fuels. The country's economy is based on imports of raw materials for processing into manufactures for export. In 1987, Taiwan's gross domestic product (GDP) at current prices was $88.6 billion.[2] The value of manufacturing, the largest component of the GDP, was $33.8 billion. The input of mining and quarrying, the smallest component, was only $456 million. The bulk of the value of the mining sector was the output of natural gas, condensate, and coal. The remaining value was from small operations of industrial minerals, dominated by dolomite, limestone, and marble.

The input of mining and quarrying to the GDP decreased from 0.53% in 1986 to 0.51% in 1987. In comparison, manufacturing accounted for 38.2% of the GDP in 1987, followed by commerce, 15.0%; Government services, 10.5%; agriculture, 6.1%; housing, 5.5%; transportation and communication, 5.2%; and other, 19.0%. The significance of the mining sector was expected to diminish further because of the decline in domestic coal output. Annual mine output of coal decreased from 2.6 million tons in 1980 to 1.9 million tons in 1985 and to less than 1.5 million tons in 1987.[3]

Taiwan's population in 1987 was 19.6 million with a labor force of 8.0 million. Employment by sector was as follows: agriculture, 1.2 million; industry, 3.4 million; and services, 3.4 million. Employment in the mining sector has declined, reflecting the drop in mining activity. Employment in the mining sector decreased from 67,000 in 1975 down to 56,000 in 1980, and dropped to 31,000 by 1987.

The average work month in mining was 180 hours compared with 210 hours for manufacturing. The average monthly salary in the mining sector was $630 compared with the highest average wage in the utility sector of $920, and the lowest average in the manufacturing sector of $485.

Owing to the Government's past program of promoting rapid growth of industry, the environment has suffered from pollution. The public has become increasingly sensitive to the problem and has insisted on corrective action. Local activism forced the delay in the construction of a titanium dioxide pigment plant and the expansion of Taiwan's nuclear power generation capacity.

PRODUCTION

Taiwan's mineral resource base is weak. By value, the most important mining sector in 1987 was mineral fuels. However, the domestic output of coal, natural gas, and oil was significant only in that it provided as much as 6% of the nation's supply of energy. Mine production of metallic minerals historically has been minor and sporadic. The last domestic production of metal ore, which was from a small copper mine in northern Taiwan, ended early in the decade. In terms of tonnage, the output of carbonate minerals dominated the remainder of the output of the domestic mining industry. In 1987, marble for dimension stone was valued as an export-earner while limestone quarrying was largely captive of the cement producers. The remainder of the output was an array of industrial minerals in minor quantities of asbestos, chiolite,

clays, feldspar, gem stones, mica, salt, serpentine, and talc.

State-owned enterprises produced all natural gas, oil, and salt, and essentially all dolomite and sulfur. Limestone was produced largely by the private sector, coal by a mix of state-owned and private companies, marble by a Government-promoted company for retired military personnel, and the remainder of minerals by small private companies.

The largest metal sector was iron and steel. The country's only integrated iron and steel complex was state-owned and accounted for 70% of the total raw steel output. Electrolytic copper was produced by a state-owned refinery that also produced gold and silver. Secondary metal recovery was primarily ferrous scrap from Taiwan's shipbreaking industry, the largest in the world.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS					
Copper: Metal, refined	37,960	48,436	46,734	50,439	46,961
Gold, primary troy ounces	52,361	37,794	30,633	29,270	17,152
Iron and steel: Metal:					
Pig iron thousand tons	3,415	3,360	3,429	3,740	[e]3,900
Ferroalloys:					
Ferromanganese	21,763	19,803	18,508	20,040	17,026
Ferrosilocomanganese	18,509	23,082	22,688	20,933	18,944
Ferrosilicon	18,304	23,714	17,272	14,007	7,058
Steel, crude thousand tons	5,017	5,224	5,326	5,679	5,949
Lead, refinery, secondary[e]	38,000	44,300	44,400		
Silver, primary troy ounces	345,273	364,274	366,078	405,521	315,382
INDUSTRIAL MINERALS					
Asbestos	2,819	1,355	625		
Cement, hydraulic thousand tons	14,810	14,234	14,418	14,806	15,663
Clays:					
Fire clay	36,926	52,479	63,446	64,652	76,005
Kaolin	102,895	79,411	76,605	63,228	67,525
Feldspar	11,866	15,452	11,055	26,290	28,116
Gypsum:					
Precipitated	1,522	1,882	2,199	2,247	1,378
Other	1,500				
Lime	131,862	117,496	105,132	109,690	105,005
Mica	311	304	114	774	787
Nitrogen: N content of ammonia	310,594	268,427	206,781	265,248	243,275
Pyrite, gross weight			[r]8	10	
Salt, marine	79,188	218,491	173,898	136,078	99,943
Sodium compounds, n.e.s.:					
Caustic soda	295,349	350,527	386,505	365,913	378,244
Carbonate (soda ash)	93,820	107,210	112,018	133,358	127,332
Stone:					
Dolomite thousand tons	228	258	231	258	340
Limestone do.	13,183	12,936	12,722	12,462	12,407
Marble do.	9,281	9,542	10,259	10,603	11,062
Serpentine do.	116	123	208	234	253
Sulfur:					
S content of pyrite			4	5	
Byproduct, all sources	26,936	28,705	42,949	62,980	89,082
Total	26,936	28,7045	42,953	62,985	89,082
Talc	27,053	18,680	17,560	21,552	22,102
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	32,968	39,842	43,264	48,363	53,559
Coal, bituminous thousand tons	2,236	2,011	1,858	1,725	1,499
Coke do.	150	141	132	148	118
Gas, natural:					
Gross[e] million cubic feet	48,000	49,000	44,000	40,000	41,000
Marketed do.	43,689	44,698	39,371	36,111	37,325

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum:					
Crude ------ thousand 42-gallon barrels	847	855	743	660	[e]650
Refinery products:					
Gasoline ------ do	17,422	17,518	25,408	18,128	18,500
Kerosene ------ do	86	61	282	956	950
Distillate fuel oil ------ do	21,898	21,972	23,852	19,480	19,500
Residual fuel oil ------ do	58,019	56,426	56,080	53,591	53,500
Lubricants ------ do	835	951	856	887	900
Asphalt ------ do	2,406	2,311	2,999	3,195	3,500
Other[2] ------ do	3,449	8,517	9,916	3,478	3,500
Refinery fuel, losses and not reported[e 3] do	27,000	27,000	30,000	25,000	25,000
Total ------ do	131,115	134,756	149,393	125,375	126,000

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Includes data available through July 5, 1988.
[2]Naphtha, solvent oil, and base oil.
[3]Includes liquefied petroleum gas and jet fuel.

TRADE

The value of Taiwan's total trade in 1987 was $98.1 billion, comprising $59.6 billion for exports and $38.5 billion for imports. The United States was the largest export destination with shipments valued at $26.4 billion, followed by Japan, $7.7 billion; Hong Kong, $4.6 billion; the Federal Republic of Germany, $2.2 billion; Canada and the United Kingdom, $1.7 billion each, and Singapore, $1.5 billion. The remainder was scattered to a host of trading partner countries mostly on the Pacific rim.

Receipts from Japan were valued at $13.2 billion and from the United States, $8.5 billion. Other major import sources were the Federal Republic of Germany, $1.8 billion; Saudi Arabia, $1.2 billion; Australia, $1.1 billion; and Hong Kong, Kuwait, Malaysia, and the United Kingdom, each with less than $1.0 billion.

Electrical equipment and apparatus was the largest export class to the United States, valued at $7.3 billion, followed by textile and apparel, $3.2 billion; rubber and plastic products, $3.1 billion; metal products and manufactures, $2.3 billion; wood products, $1.4 billion; and miscellaneous manufactured products, $3.2 billion. The largest import classes from the United States were electrical equipment and apparatus, $1.6 billion; chemical and agricultural products, $1.3 billion each; and basic metals, $0.8 billion.

Taiwan's industrial strength lies in processing imported raw materials into finished goods and manufactures for export. Imports of minerals included iron ore valued at $147 million; copper ore, $62 million; manganese ore, $8.4 million; chromium ores, $0.7 million; and other ores and concentrates, $10.6 million. Imports of fuel products included coal, $663.6 million, and crude oil, $2,822.5 million.[4]

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides ------	4,734	6,384	--	Republic of Korea 4,068; Panama 2,000.
Metal including alloys, all forms ---	32,186	33,847	1,494	Japan 15,253; Hong Kong 12,912.
Columbium and tantalum: Metal including alloys, all forms, tantalum --	22	5	1	West Germany 2.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Copper:				
Matte and speiss including cement copper	7	13	--	Japan 12.
Sulfate	161	270	--	Philippines 148; Spain 97.
Metal including alloys:				
Scrap	7,453	6,186	302	Japan 3,770; Netherlands 1,259.
Unwrought	90	49	2	Republic of Korea 39.
Semimanufactures	12,666	17,608	1,194	Singapore 2,857; Republic of Korea 1,591; Japan 1,451.
Gold: Waste and sweepings	21	19	19	
Iron and steel: Metal:				
Scrap	388,225	280,941	121	Thailand 224,795.
Pig iron, cast iron, related materials	2,186	4,766	2,824	Australia 524.
Ferroalloys	2,689	1,435	8	Japan 909; Republic of Korea 189.
Steel, primary forms	159,078	86,250	86	Japan 82,417.
Semimanufactures, thousand tons	1,735	1,424	423	Japan 270; Hong Kong 151; Singapore 66.
Lead:				
Oxides	--	68	--	Indonesia 58; Thailand 10.
Metal including alloys, all forms	20,755	23,755	38	Japan 9,607; Republic of Korea 7,901.
Magnesium: Metal including alloys, all forms	466	572	58	Netherlands 307; Japan 200.
Manganese:				
Ore and concentrate	(2)	31	--	Republic of Korea 17; Indonesia 7.
Oxides	--	29	--	Philippines 17; Hong Kong 12.
Molybdenum: Metal including alloys, all forms, kilograms	1,497	968	52	Indonesia 715; Hong Kong 200.
Nickel: Metal including alloys:				
Scrap	1,889	1,506	--	Japan 1,279.
Unwrought and semimanufactures	402	382	6	Australia 305.
Platinum-group metals:				
Waste and sweepings[3]	10	2	1	NA.
Metals including alloys, unwrought and partly wrought, troy ounces	1,575	77,515	63,465	Malaysia 9,324.
Rare-earth metals including alloys, all forms	15	62	--	Singapore 44; Indonesia 18.
Silicon, high-purity	r1	3	--	India 1; Indonesia 1.
Silver:				
Waste and sweepings	--	2	1	Thailand 1.
Metal including alloys, unwrought and partly wrought, troy ounces	30,543	39,995	--	United Kingdom 21,187; Hong Kong 7,780.
Tin:				
Oxides, kilograms	267	--		
Metal including alloys, all forms	401	641	33	Hong Kong 311; Japan 88.
Titanium: Oxides	30	395	381	Nigeria 13.
Tungsten: Metal including alloys, all forms	63	8	--	Japan 7.
Uranium and/or thorium: Metal including alloys, all forms	65	298	185	Belgium-Luxembourg 20; Canada 19; France 15.
Zinc:				
Oxides	2,760	2,837	--	Japan 2,279.
Blue powder	182	14	3	Nigeria 8.
Metal including alloys, all forms	997	1,114	714	Hong Kong 108; Japan 73.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	26	52	5	Thailand 33.
Artificial: Corundum	388	390	4	Japan 371.
Dust and powder of precious and semiprecious stones including diamond, kilograms	9,155	23,553	11,924	Saudi Arabia 4,699; United Arab Emirates 1,575.
Grinding and polishing wheels and stones	2,724	3,182	1,149	Hong Kong 369; Thailand 330; Indonesia 303.
Boron materials: Oxides and acids, kilograms	91	500	--	All to Indonesia.
Cement, thousand tons	3,994	3,545	(2)	Hong Kong 1,536; Japan 941; Singapore 815.
Chalk	--	600	--	All to Indonesia.
Clays, crude	2,032	996	--	Philippines 628; Japan 199.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Diamond:				
Natural:				
Gem, not set or strung thousand carats	6,600	12,340	6,250	Netherlands 3,545; West Germany 1,580.
Industrial stones do.	34,800	12,440	8,150	Japan 4,010.
Synthetic:				
Gem, not set or strung do.	16,500	8,190	7,250	Italy 695.
Industrial stones do.	164,990	328,180	4,585	Thailand 146,825; Republic of Korea 138,945.
Diatomite and other infusorial earth	60	34	--	Malaysia 26.
Feldspar, fluorspar, related materials	12	166	--	Japan 58; Indonesia 55.
Fertilizer materials: Manufactured:				
Ammonia	34	17	--	All to Hong Kong.
Nitrogenous	1,025	905	--	Haiti 500; Japan 400.
Phosphatic	100	4,129	--	Fiji 2,000; Japan 1,108; Malaysia 1,000.
Potassic	12,600	25,855	--	Japan 17,600; Hong Kong 7,005.
Unspecified and mixed	2,455	5,368	--	Japan 2,999; Haiti 2,000.
Graphite, natural	188	204	--	Japan 113; Indonesia 53.
Gypsum and plaster	553	726	8	Indonesia 600.
Iodine kilograms	2,379	1,400	--	India 725; Republic of Korea 450.
Magnesium compounds, unspecified	--	505	--	Indonesia 425.
Meerschaum, amber, jet kilograms	25,389	5,082	--	Ireland 2,952 Philippines 549; Canada 478.
Mica, all forms	337	281	--	Japan 118; New Zealand 89; Indonesia 22.
Pigments, mineral: Iron oxides and hydroxides, processed	2	35	10	Indonesia 18.
Precious and semiprecious stones other than diamond:				
Natural kilograms	104,073	131,696	17,972	Hong Kong 27,818; Thailand 26,694; Italy 16,360.
Synthetic do.	37,918	43,708	13,936	Italy 10,734; Hong Kong 4,504.
Salt and brine	1,472	1,950	--	All to Hong Kong.
Sodium compounds, n.e.s.: Sulfate, manufactured	31,292	23,984	--	Japan 8,928; Republic of Korea 4,575; Singapore 2,700.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	7,132	12,194	81	Japan 9,411; West Germany 343.
Worked	45,062	30,434	2,546	Saudi Arabia 20,174; Japan 4,029.
Dolomite, chiefly refractory-grade	47,250	82,116	NA	Japan 80,880.
Gravel and crushed rock	193,614	170,932	40	Japan 163,209.
Limestone other than dimension	10,129	9,094	--	Malaysia 4,700; Japan 3,720.
Quartz and quartzite	--	13	--	Japan 10.
Sand other than metal-bearing	337,972	309,555	7	Japan 308,816.
Sulfur:				
Elemental:				
Crude including native and byproduct	1,497	1,192	--	Indonesia 781; Philippines 312.
Colloidal, precipitated, sublimed	75	153	--	Indonesia 100; Australia 25.
Sulfuric acid	246	104	--	Hong Kong 37; Australia 30; Nigeria 19.
Talc, steatite, soapstone, pyrophyllite	509	695	--	Indonesia 448; Philippines 100.
Other:				
Crude	1,628	5,328	120	Thailand 3,223; Philippines 809.
Slag and dross, not metal-bearing	60,059	80,572	5	Japan 62,815; Philippines 11,165.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	9,281	10,023	--	Indonesia 7,587; Thailand 953.
Coal, all grades including briquets	(2)	--		
Coke and semicoke	9,364	13,257	--	Indonesia 6,432; Japan 3,838; Thailand 1,200.
Peat including briquets and litter	18	256	--	All to Japan.
Petroleum refinery products:				
Gasoline, motor 42-gallon barrels	9	9	(2)	Mainly to Japan.
Mineral jelly and wax	551	39	--	Hong Kong 8; Nigeria 8; West Germany 8.
Kerosene and jet fuel thousand 42-gallon barrels	11,210	9,785	379	Japan 4,750; Philippines 1,892.
Distillate fuel oil do.	7,932	8,246	NA	NA.
Lubricants do.	724	773	295	United Arab Emirates 133; Singapore 117.
Petroleum coke do.	(2)	908	408	Indonesia 314.

[r] Revised. NA Not available.
[1] Table prepared by Audrey D. Wilkes.
[2] Less than 1/2 unit.
[3] May include other precious metals.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	19,518	47,261	--	All from Malaysia.
Oxides and hydroxides	7,680	5,725	208	Japan 4,982; Australia 325.
Metal including alloys:				
Scrap	6,237	13,055	9,144	Republic of South Africa 860; Australia 676.
Unwrought	147,204	155,956	12,532	Australia 66,044; Republic of South Africa 17,532; Canada 16,938.
Semimanufactures	32,293	32,440	583	Japan 12,712; Australia 8,652.
Antimony: Oxides	380	765	56	France 371; Japan 127.
Arsenic: Oxides and acids	368	563	--	France 529.
Cadmium: Oxides and hydroxides	249	476	(2)	Republic of Korea 383; Belgium-Luxembourg 72.
Chromium:				
Ore and concentrate	10,726	19,048	(2)	Republic of South Africa 17,967.
Oxides and hydroxides	1,938	2,881	397	Japan 1,344; West Germany 817.
Cobalt: Oxides and hydroxides	23	66	1	Belgium-Luxembourg 53.
Copper:				
Ore and concentrate	160,931	179,704	19,067	Canada 96,308; Chile 20,978; Mexico 19,441.
Sulfate	364	480	40	Japan 384.
Metal including alloys:				
Scrap	28,400	42,508	24,122	Hong Kong 6,892; Japan 3,335; Saudi Arabia 2,443.
Unwrought	47,665	109,476	1,424	Philippines 40,637; Japan 22,060; Chile 18,898.
Semimanufactures	41,378	58,075	3,001	Japan 38,627.
Gold:				
Bullion, troy ounces	376,591	731,100	--	West Germany 309,891; Switzerland 260,154; Republic of South Africa 84,817.
Metal including alloys, unwrought and partly wrought, thousand troy ounces	1,109	886	266	Japan 617.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite, thousand tons	4,896	5,358	(2)	Australia 3,021; Brazil 1,835.
Pyrite, roasted	11,360	9,460	--	All from Philippines.
Metal:				
Scrap	694,665	1,225,472	776,431	Hong Kong 133,828; Japan 96,031.
Pig iron, cast iron, related materials	180,392	319,790	1,394	Brazil 226,451; Japan 61,456.
Ferroalloys	16,159	51,540	60	Republic of South Africa 32,583; Philippines 6,128.
Steel, primary forms	242,559	600,668	88	Brazil 231,723; Japan 148,078; Republic of South Africa 114,204.
Semimanufactures, thousand tons	1,196	1,900	49	Japan 1,557.
Lead:				
Ore and concentrate	(2)	--		
Oxides	2,754	2,935	(2)	Australia 2,323; West Germany 493.
Metal including alloys:				
Scrap	54,839	89,536	54,602	Saudi Arabia 10,043; Australia 9,576.
Unwrought	12,272	16,154	1,658	Australia 8,464; Japan 3,365; Peru 2,246.
Semimanufactures	29	19	6	Japan 13.
Magnesium: Metal including alloys, all forms	720	951	206	Norway 507.
Manganese:				
Ore and concentrate	128,970	119,241	6	Republic of South Africa 58,072; Gabon 32,500; Australia 19,181.
Oxides	1,624	2,625	2	India 923; Japan 697; Republic of South Africa 476.
Metal including alloys, all forms	35	35	1	Republic of South Africa 19; United Kingdom 14.
Mercury, 76-pound flasks	290	282	136	Japan 131.
Molybdenum: Metal including alloys, all forms	60	85	49	West Germany 28.
Nickel:				
Matte and speiss	2,938	11,514	--	Canada 9,362; Japan 1,853.
Metal including alloys:				
Scrap	396	1,223	638	Canada 391; Netherlands 189.
Unwrought	3,863	6,535	29	Canada 3,279; Norway 1,529.
Semimanufactures	302	691	48	Canada 186; Japan 104; Australia 103.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Platinum-group metals:				
Ore and concentrate[3] value, thousands	$35	$78	--	All from United Kingdom.
Metals including alloys, unwrought and partly wrought thousand troy ounces	69	19	8	Japan 10.
Rare-earth metals including alloys, all forms	178	178	37	Japan 109.
Selenium, elemental	34	27	(2)	Japan 19; United Kingdom 5.
Silicon, high-purity	1,609	2,698	4	Canada 1,144; Norway 1,008.
Silver:				
Waste and sweepings[3] value, thousands	$387	$61	$59	West Germany $1.
Metal including alloys, unwrought and partly wrought thousand troy ounces	1,515	2,403	280	Japan 896; Australia 435.
Tin: Metal including alloys, all forms	2,090	4,938	13	Malaysia 3,113; Thailand 822.
Titanium: Oxides	9,950	13,187	404	Japan 6,101; West Germany 3,914.
Tungsten: Metal including alloys, all forms	46	56	20	Japan 29.
Uranium and/or thorium: Oxides and other compounds	20	38	2	France 14; Norway 11.
Zinc:				
Oxides	210	326	19	Japan 213; Republic of Korea 65.
Blue powder	244	206	1	West Germany 54; Greece 40; United Kingdom 39.
Metal including alloys:				
Scrap	19,837	69,369	49,769	West Germany 7,036; Canada 4,009.
Unwrought	54,423	79,000	161	Australia 36,008; Canada 14,219; Japan 10,379.
Semimanufactures	784	927	4	Japan 770.
Other:				
Oxides and hydroxides	330	1,519	70	Australia 1,192.
Ashes and residues	19,013	28,021	8,979	Australia 5,110; Japan 3,978; Canada 3,232.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	2,726	4,533	486	Japan 1,795; Indonesia 1,245.
Artificial: Corundum	8,779	18,218	432	Japan 9,869; Hong Kong 4,455; Brazil 1,520.
Asbestos, crude	24,519	39,735	4,466	Canada 17,025; Republic of South Africa 14,020.
Barite and witherite	4,131	6,636	--	Thailand 6,635.
Boron materials:				
Crude natural borates	2,142	2,345	--	Japan 1,304; Netherlands 600.
Oxides and acids	1,684	2,019	1,775	Italy 162.
Bromine	14	(2)	--	Mainly from Japan.
Cement	5,232	10,053	(2)	Japan 5,578; Denmark 2,869.
Clays, crude:				
Bentonite	16,623	18,624	15,528	Republic of South Africa 1,248; India 1,025.
Fire clay	457	632	--	All from Japan.
Kaolin	80,129	120,134	49,760	Indonesia 26,475; Malaysia 13,627; Japan 10,946.
Unspecified	128,317	158,808	7,939	Hong Kong 97,705; Japan 31,758.
Cryolite and chiolite	216	108	--	Mainly from Denmark.
Diamond:				
Natural:				
Gem, not set or strung thousand carats	[4]105	1,250	--	Mainly from Republic of South Africa.
Industrial stones do.	[5]620	1,580	(2)	Japan 1,570.
Synthetic:				
Gem, not set or strung do.	885	1,155	--	Mainly from Hong Kong.
Industrial stones do.	2,075	820	45	Japan 560.
Diatomite and other infusorial earth	3,544	4,296	3,036	Japan 655.
Feldspar, fluorspar, related materials	140,593	158,131	703	Thailand 49,183; Hong Kong 48,635; Japan 29,111.
Fertilizer materials: Manufactured:				
Ammonia	153,528	155,287	35,434	Indonesia 47,473; Australia 20,504.
Nitrogenous	176,530	122,131	(2)	Saudi Arabia 118,184.
Phosphatic	64	110	--	Republic of South Africa 91.
Potassic	130,566	212,492	36,886	Israel 61,600; Canada 60,906; Jordan 34,050.
Unspecified and mixed	8,218	2,202	278	Japan 789; West Germany 499.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Graphite, natural	8,428	8,513	21	Republic of Korea 6,530; Sri Lanka 684; Japan 525.
Gypsum and plaster	411,838	401,118	637	Thailand 313,914; Japan 57,170.
Iodine	35	23	--	Mainly from Japan.
Magnesium compounds:				
Oxides and hydroxides	r8,592	29,016	221	India 11,425; Japan 9,184; Malaysia 4,700.
Other	20,242	8,698	35	India 5,150; Malaysia 2,420.
Mica:				
Crude including splittings and waste	193	445	3	Malaysia 286; India 109.
Worked including agglomerated splittings	452	192	5	Japan 173.
Phosphates, crude	308,858	330,763	(2)	Jordan 223,598; Morocco 60,857; Israel 41,288.
Phosphorus, elemental	1,404	2,899	1,461	Republic of South Africa 1,375.
Pigments, mineral:				
Natural, crude	10	5	--	Japan 3.
Iron oxides and hydroxides, processed	16,694	22,397	498	Japan 15,611; West Germany 1,750.
Precious and semiprecious stones other than diamond:				
Natural	3,166	7,616	75	Brazil 3,627; Republic of South Africa 2,462.
Synthetic	13	10	1	Japan 4; Belgium-Luxembourg 2.
Salt and brine	805,115	859,515	19	Australia 802,274.
Sodium compounds, n.e.s.: Carbonate, natural and manufactured	17,564	31,100	26,581	Kenya 4,500.
Stone, sand and gravel:				
Dimension stone: Crude and partly worked	45,829	66,742	96	India 19,033; Italy 13,647; Spain 9,471.
Dolomite, chiefly refractory-grade	2,052	3,340	68	United Kingdom 1,856; Thailand 963.
Limestone other than dimension	20	22,080	(2)	Philippines 21,759.
Quartz and quartzite	2,103	1,573	11	India 640; Hong Kong 290.
Sand other than metal-bearing	9,459	10,726	135	Malaysia 7,718; Japan 1,625.
Sulfur:				
Elemental:				
Crude including native and by product	74,955	60,515	13,098	Canada 47,287.
Colloidal, precipitated, sublimed	158,334	261,370	35,578	Canada 216,762.
Sulfuric acid	98,406	125,521	138	Japan 125,355.
Talc, steatite, soapstone, pyrophyllite	10,744	12,230	1,777	Republic of Korea 5,613; Thailand 2,240.
Vermiculite	461	1,146	--	United Kingdom 480; Republic of South Africa 378; India 270.
Other:				
Crude	118,000	112,003	1,503	Republic of Korea 93,600; Japan 10,934.
Slag and dross, not metal-bearing	16,775	14,460	73	Japan 14,241.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	155	98	98	
Carbon black	4,601	9,265	2,347	Australia 3,594; Japan 1,745.
Coal, all grades including briquets thousand tons	10,270	11,003	3,111	Australia 5,088; Republic of South Africa 2,026.
Coke and semicoke	172,957	157,722	--	Japan 157,679.
Peat including briquets and litter	209	396	--	Finland 175; Sweden 66; West Germany 59.
Petroleum:				
Crude thousand 42-gallon barrels	119,944	126,337	--	Saudi Arabia 45,777; Kuwait 23,781; United Arab Emirates 13,200.
Refinery products:				
Liquefied petroleum gas do	4,429	6,638	--	Saudi Arabia 4,444 Kuwait 840.
Mineral jelly and wax do	109	158	31	Japan 76; Indonesia 14.
Distillate fuel oil do	3,965	12,089	1	United Kingdom 10,233; Spain 1,110.
Lubricants do	457	596	202	Japan 223.
Nonlubricating oils do	127	995	85	Singapore 370; Republic of Korea 217; Philippines 195.
Petroleum coke do	188	557	497	Japan 39.

rRevised.
[1]Table prepared by Audrey D. Wilkes.
[2]Less than 1/2 unit.
[3]May include other precious metals.
[4]Excludes unreported quantity valued at $1,159,300.
[5]Excludes unreported quantity valued at $80,400.

COMMODITY REVIEW

METALS

Taiwan's primary metals industry was limited to copper and iron and steel. Primary aluminum metal production by Taiwan Aluminium Corp. (Talco) ceased in 1982. The Government transferred Talco to the state-owned Taiwan Power Co. (Taipower), which was to continue the rolling operation to produce aluminum sheet and foil from imported ingot.

Copper.—Taiwan Metal Mining Corp. (TMMCO), a state-owned enterprise, had a 50,000-ton-per-year copper smelter-refinery at Juifang. Because of mounting debts, TMMCO's plant facilities were transferred to Taipower in 1987, which continued the production of copper, gold, and silver. Taipower was to continue the operation of the smelter-refinery for the next 10 years but was to sell off the other assets of TMMCO to the private sector.

Iron and Steel.—China Steel Corp. (CSC), a state-owned enterprise, operated the country's only integrated iron and steel complex at Kaohsiung. In late 1987, the installation of blast furnace No. 3 was completed, fulfilling the third-stage expansion of the complex. CSC's annual production capacity of raw steel was increased from 3.2 million to 5.6 million tons. In 1987, CSC produced 56% of the nation's raw steel. It was expected to account for 76% of the raw steel output capacity in 1988.

Tang Eng Iron Works Co. Ltd. (Tang Eng), a state-owned enterprise, specialized in stainless steel production. Talent Metals Corp., which operated a 7,000-ton-per-year nickel smelter at Kaohsiung, went into receivership in 1987 and was reorganized by the Government into Taiwan Nickel Refining Co. (TaiNickel). TaiNickel was to continue to provide nickel to Tang Eng for the production of stainless steel.

In addition to private companies such as Tung Ho Steel Enterprises Inc. and Long Ching Steel Co. Ltd., there were numerous small mills operating electric furnaces and rolling facilities.

Taiwan's steel industry was dependent on foreign sources for raw materials. Iron ore was imported primarily from Australia, manganese ore from the Republic of South Africa, and coking coal from Australia. Scrap metal is produced from shipbreaking.

INDUSTRIAL MINERALS

Small quantities of asbestos, clays, feldspar, gem stones, mica, pyrite, quartz crystal, serpentine, and talc were produced by local mines. Salt was produced from evaporites by Government-owned operations. Most of the dolomite production was from captive mines of the privately owned cement producers. Cement production by 11 companies increased 6% to 15.7 million tons in 1987. Two Government-owned companies produced 1.3 million tons of compound fertilizers.

MINERAL FUELS

Taiwan's supply of primary energy was 41.6 million kiloliters in terms of oil equivalence. Domestic energy production from nuclear power accounted for 16% of the supply; hydropower, 4.4%; natural gas, 2.9%; coal, 2.8%; and oil, 0.2%. The remainder of primary energy was supplied by imports of coal, crude oil, and petroleum products.

Taiwan produced modest quantities of natural gas and associated condensate. Coal production was less than 1.5 million tons in 1987, and future output was expected to decline because of depleted resources and the closure of hazardous mines.

To increase domestic energy production, Taipower planned a fourth nuclear power station, housing reactors 7 and 8, on the northeast coast. If construction is blocked for environmental reasons, Taipower plans to construct four fossil-fuel-fired powerplants.[5]

In a further attempt to diversify energy production, Taipower planned to construct an experimental energy conversion plant in 1995. This plant would utilize energy from differential temperature gradients of seawater.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from New Taiwan dollars (NT$) to U.S. dollars at the rate of NT$28.55=US$1.00 in 1987.

[3]Council for Economic Planning and Development (Taipei). Industry of Free China. V. 69, No. 2, Feb. 1988, 206 pp.

[4]Executive Yuan (Taipei). Monthly Statistics of the Republic of China. No. 266, Feb. 1988, 213 pp.

[5]American Institute in Taiwan (Taipei). State Dep. Aitgram A-018, Dec. 18, 1987.

The Mineral Industry of Thailand

By John C. Wu[1]

The overall performance of the Thai mineral industry improved considerably from that of 1986 owing to higher domestic and overseas demand for most of the 36 minerals produced in Thailand. The value of mineral output rose 19% over that of 1986. According to the Department of Mineral Resources (DMR), the top eight minerals produced in 1987 were fluorite, gypsum, kaolin, lead, lignite, limestone, tin, and zinc.

A stronger overseas demand pushed up the output of feldspar, gypsum, ilmenite, and tungsten. However, a higher domestic demand was the major driving force for increased production of kaolin, lignite, limestone, manganese, and zinc. Tin, which by value contributed most to the output of the mining industry and ranked as the top mineral produced in Thailand in the past, dropped to third place because of a 12% decline in output. The seven-member Association of Tin Producing Countries (ATPC) agreed early in the year to limit Thai tin exports to 19,000 tons in 1987. Barite and fluorite, among the top eight minerals in 1986, also suffered a decline in output in 1987 because of reduced exports.

Output of lignite and natural gas increased substantially, primarily because of a Government policy to exploit indigenous resources to meet the growing demand for energy. In 1987, the Asian Development Bank provided a $38.4 million[2] loan to expand the capacity of the country's largest lignite mine at Mae Moh, Lampang Province. In August, the state-owned Petroleum Authority of Thailand (PTT) reached an agreement with Esso Exploration and Production Khorat Inc. to buy natural gas from Esso's Nam Phong Gasfield for a powerplant to be built nearby. In November, PTT also agreed to buy back from Texas Pacific Thailand (TP) of the United States, the country's largest offshore gasfield. The Government planned to jointly develop the gasfield with foreign oil companies in the next few years. Thai Shell Exploration and Production Co. Ltd., operator of the onshore Sirikit Oilfield in Kamphaeng Phet Province, completed development of Thailand's first offshore oilfield.

In the mineral processing sector, production of primary tin was much lower than capacity because of a shortage of tin concentrate. Production of refined antimony and zinc was near capacity because of increased antimony exports and increased domestic demand for slab zinc by the growing zinc alloy sector. Padaeng Industry Co. Ltd. (PDI) was expanding the capacity of its Tak zinc smelter in Tak Province by 10,000 to 70,000 tons per year. In November, PDI also completed its 5,000-ton-per-year zinc alloy plant near the smelter.

However, Thailand's first lead smelter did not come on-stream as planned. Local environmental groups were said to have forced the postponements. Construction of a new tantalum and columbium processing plant at Map Ta Put in Rayong Province to replace the burned-down Phuket Island plant was also postponed. The Thai operating company and Bayer AG of the Federal Republic of Germany were embroiled in a dispute over transferring extraction technology to Thailand. In 1987, Siam City Cement Co. Ltd. opened its new cement plant in Saraburi Province. As a result, the Thai cement industry expanded its capacity to 12.9 million tons per year.

According to the Bank of Thailand (BOT), the nation's central bank, the mining industry contributed about 2% to the Thai gross domestic product (GDP) in 1987. Because of

better export and financial market conditions, output of both the export-oriented manufacturing and construction sectors increased at a substantially higher rate than in 1986. Thai real GDP in 1972 constant dollars grew 6.6% compared with 3.5% in 1986.[3] In 1972 constant dollars, Thai real GDP was estimated at $16.6 billion in 1987 while output of the mining industry was estimated to be $330 million. The increased output of lignite, limestone, natural gas, and zinc contributed most to the overall growth of the mining industry. The Thai inflation rate, as measured by the change in the nation's Consumer Price Index, increased slightly to 2.5% from 1.9% in 1986. As a result of larger imports, the Thai merchandise trade deficit increased to $1.8 billion from $0.5 million in 1986.

Government Policies and Programs.—To assist the mining industry for continued growth, the Government approved in principle the restructuring of its fixed-rate royalty levied on lead, tungsten, and zinc to a sliding scale royalty. For lead ore, the royalty would be reduced to a minimum of 2% per ton and a maximum of 15%. For tungsten ore, the 20% fixed-rate royalty would be reduced to a minimum of only 0.5% for prices less than $120 per picul and 5%, 10%, 15%, and 20% on prices of $120 to $159, $160 to $199, $200 to $239, and more than $239 per picul, respectively. For zinc ore, the 10% fixed-rate royalty would be reduced to a minimum of 2% for prices up to $399 per ton of metal and a maximum of 10% for prices from $797 to $1,196 per ton. According to an industry source, the Thai Government was also considering better terms for oil and gas exploration and development contracts to attract more private investment. The two key points under review by the Government were a shorter production period for each concession and a sliding scale based on production rate to replace the existing 12.5% fixed-rate royalty.[4]

PRODUCTION

According to the DMR, the value of the Thai mineral output rose 19% to $415 million owing mainly to a significant increase in production of antimony, sodium-grade feldspar, gypsum, ilmenite, and tungsten because of higher overseas demand for these mineral commodities and higher prices for lead and zinc. Kaolin, limestone, battery-grade manganese, and zinc also were more plentifully produced owing to increased domestic demand caused by improved Thai economic conditions. Despite a slight increase in the tin market price, the tin industry remained depressed because the Thai Government supported an agreement by the seven-member ATPC to reduce surplus tin stocks. As a result, the output of tin concentrates dropped to less than 21,000 tons in 1987. Because of reduced exports, other minerals that registered a decline in output included barite, metallurgical-grade fluorite, lead, and potassium-grade feldspar. No acid-grade fluorite was produced due to lack of overseas demand.

Production of lignite from the Mae Moh Mine in Lampang and natural gas from offshore Erawan and other gasfields in the Gulf of Thailand rose substantially owing to increased demand by the domestic utilities and manufacturers. Output of crude petroleum including natural gas condensate dropped slightly due to reduced output from the onshore Sirikit Oilfield in Kamphaeng Phet. Crude petroleum output was expected to increase by 6,000 to 10,000 barrels per day when Thailand brings on-stream its first offshore Nang Nuan Oilfield in the central Gulf of Thailand in early 1988.

In the nonfuel mineral processing sector, both the 1,000-ton-per-year antimony smelter, which came on-stream near Bangkok in late 1986, and the 60,000-ton-per-year zinc smelter in Tak operated at near capacity in 1987. However, the 38,000-ton-per-year tin smelter in Phuket operated at far below capacity in the first half of 1987 owing to the shortage of tin concentrates. Production of cement rose to more than 9.9 million tons.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS					
Antimony:					
Ore and concentrate:					
Gross weight	2,808	4,636	2,917	2,397	962
Sb content[e]	1,193	1,970	1,240	1,019	409
Metal, smelter	13	--	135	386	959
Columbium and tantalum ores and concentrates, gross weight:[2]					
Columbite and tantalite:					
Gross weight kilograms	549,000	477,000	432,000	121,000	180,000
Cb content do.	93,300	81,000	73,400	20,600	30,600
Ta content do.	126,300	128,800	116,640	32,670	48,600
Stuverite:					
Gross weight do.	275,000	30,000	309,000	241,000	--
Cb content do.	22,100	2,400	24,800	19,300	--
Ta content	21,400	2,300	24,000	18,800	--
Iron and steel:					
Iron ore:					
Gross weight	40,304	60,670	93,800	37,330	97,123
Fe content	22,167	33,369	51,590	20,532	53,419
Metal:					
Pig iron	159	--	--	--	--
Steel:					
Crude	r340,100	380,971	r447,035	463,393	534,172
Semimanufactures (selected):					
Bars	r220,870	281,934	r319,330	303,652	319,835
Galvanized iron sheets	r123,386	r151,537	r131,520	144,444	165,445
Tinned plates	r73,108	r91,991	68,175	104,433	119,342
Lead:					
Mine output, Pb content of 42.5% Pb concentrate	r21,019	16,662	19,654	26,301	23,503
Metal: Ingot, secondary	3,174	6,198	7,536	9,122	11,366
Manganese ore:					
Chemical-grade, over 75% MnO_2	--	8	27	--	50
Battery- and chemical-grade, 75% MnO_2	4,804	6,110	3,930	4,001	4,597
Metallurgical-grade, 46% to 50% MnO_2	1,906	2,577	455	887	4,086
Total, gross weight	6,710	8,695	4,412	4,888	8,733
Total, Mn content	3,221	4,174	2,118	2,346	4,192
Rare-earth metals:					
Monazite concentrate, gross weight	r257	298	r663	1,609	150
Xenotime	38	28	r158	28	--
Tin:					
Mine output, Sn content	r19,942	r21,607	r16,593	16,800	14,852
Metal, smelter, primary	18,467	19,729	17,996	19,672	15,438
Titanium:					
Ilmenite concentrate, gross weight	205	r148	r1,078	13,489	450
Leucoxine concentrate, gross weight	--	388	488	797	800
Tungsten concentrate:					
Mine output, gross weight	1,092	1,439	1,137	922	1,269
Mine output, W content	562	741	586	479	705
Zinc:					
Mine output, gross weight	--	147,993	276,909	373,833	341,145
Mine output, Zn content	--	41,438	77,535	97,197	88,698
Metal, smelter, primary	--	--	62,108	58,552	66,868
Zirconium ore and concentrate, gross weight	199	290	r1,292	1,705	845
INDUSTRIAL MINERALS					
Barite	187,437	174,918	230,970	142,232	33,370
Cement, hydraulic thousand tons	r7,301	r8,271	7,916	7,940	9,850
Clays:					
Ball clay	4,960	2,520	7,988	11,203	57,719
Kaolin	36,350	58,616	106,704	116,037	184,082
Kaolinite (dickite)	--	--	--	16,118	22,389
Diatomite	425	471	410	204	177
Feldspar	47,908	74,404	r104,586	115,163	168,881
Fluorspar:					
Crude mine output:					
High-grade	159,959	230,228	263,059	156,409	102,398
Low-grade	77,716	r64,995	91,500	40,715	2,154
Total	237,675	r295,223	354,559	197,124	104,552
Salable product:					
Acid-grade (beneficiated low-grade)	46,689	57,151	35,840	11,500	--
Metallurgical-grade	159,959	230,228	263,059	156,409	102,398
Total	206,648	287,379	298,899	167,909	102,398

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
INDUSTRIAL MINERALS —Continued					
Graphite	86				
Gypsum	760,361	1,110,660	1,273,459	1,665,557	3,030,919
Phosphate rock, crude	5,158	3,075	4,072	4,940	4,502
Salt:					
Rock	5,679	9,850	12,786	2,000	3,268
Other[e]	165,000	165,000	165,000	165,000	165,000
Sand, silica	116,094	166,787	[r]152,133	153,565	153,516
Stone:					
Calcite	1,871	1,272	1,040	230	2,170
Dolomite	7,927	10,364	16,160	13,771	50,767
Limestone for cement manufacture only thousand tons	8,936	9,223	9,845	9,605	11,391
Marble	26,428	37,927	21,479	14,718	22,786
Marl for cement manufacture only thousand tons					296
Quartz, not further described	15,159	20,687	27,305	18,068	27,459
Shale for cement manufacture only thousand tons	1,200	1,564	1,448	1,013	1,403
Talc and related materials:					
Pyrophyllite	18,875	26,851	42,002	36,165	37,749
Talc	1,273	1,628	1,476	2,886	4,101
MINERAL FUELS AND RELATED MATERIALS					
Coal: Lignite thousand tons	1,866	2,337	[r]5,146	5,545	6,929
Natural gas (gross production) million standard cubic feet	56,762	85,506	132,275	127,765	178,658
Petroleum:					
Crude thousand 42-gallon barrels	2,401	5,387	7,918	7,738	6,108
Natural gas condensate do	2,379	3,008	5,202	5,207	5,541
Refinery products:					
Liquefied petroleum gas do	1,434	1,541	1,555	1,566	[e]1,600
Gasoline do	13,365	12,620	12,836	13,837	[e]13,900
Kerosene do	2,725	1,539	1,036	931	[e]1,000
Jet fuel do	6,275	6,432	6,474	7,227	[e]7,200
Distillate fuel oil do	19,198	17,409	21,127	23,115	[e]23,200
Residual fuel oil do	13,591	15,494	13,353	13,768	[e]13,800
Refinery fuel and losses and unspecified do	[e]1,700	2,671	2,467	1,264	[e]2,000
Total do	58,288	57,706	58,848	61,708	[e]62,700

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

[1]Includes data available through July 26, 1988.

[2]Excludes columbium- and tantalum-bearing tin slags, which make Thailand the world's largest source of newly mined tantalum.

TRADE

BOT reported that Thai merchandise exports rose 26% to $11.6 billion and that imports also rose 37% to $13.4 billion in 1987. The 1987 rise on the deficit was due to increased imports of capital goods (for massive investment in new plant and equipment) and raw materials for export-oriented manufacturing.

In 1987, the major nonfuel minerals for the first 6 months in order of export earnings were as follows: primary tin and tin ore, gypsum, slab zinc, lead ore, fluorite, tungsten ore, antimony metal and ore, barite, and feldspar. Tin metal and ore remained the top mineral export commodities, accounting for 65% of nonfuel mineral exports. According to BOT, in 1986 exports of tin were valued at $118 million; crude petroleum (natural gas condensate), $56 million; slab zinc, $19 million; gypsum, $12 million; fluorite, $9 million; lead ore, $7 million; barite, $3 million; and tungsten, $2.4 million. In addition, exports of finished precious stones and jewelry were valued at $501 million in 1986.

Machinery and parts, petroleum products, chemicals, iron and steel products, and transport equipment remained the major import commodities in the first 6 months of 1987. In 1986, imports of machinery and parts totaled $2.1 billion; petroleum products, $1.2 billion; chemicals, $994 million;

iron and steel products, $599 million; and transport equipment, $340 million.

Based on two-way trade, Japan, the United States, and Singapore remained the major trade partners of Thailand in 1987. In mineral trade, exports of tin went mainly to Japan, the Netherlands, and Singapore; natural gas condensate to the United States; zinc to China, Japan, the Republic of Korea, and Malaysia; gypsum to Japan, the Republic of Korea, Malaysia, and Taiwan; fluorite to Japan, the Republic of Korea, and Taiwan; and tungsten to the Federal Republic of Germany and the United States. Imports of petroleum products were from Malaysia and Singapore; coal from Australia and the United States; iron and steel products from Japan, the Republic of Korea, and Taiwan; and nitrogenous fertilizer materials from the Federal Republic of Germany and Japan.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys, all forms	1,041	1,738	--	Malaysia 393; Singapore 380; Japan 262.
Antimony: Ore and concentrate	5,417	2,774	945	Belgium-Luxembourg 569; Brazil 389; Spain 359.
Columbium and tantalum: Ore and concentrate	88	13	--	All to Netherlands.
Copper:				
Sulfate	163	192	--	Japan 68; Malaysia 54; Hong Kong 51.
Metal including alloys, all forms	130	205	193	Singapore 7.
Gold:				
Waste and sweepings kilograms	237	393	381	Singapore 12.
Metal including alloys, unwrought and partly wrought troy ounces	32,140	18,277	18,246	Japan 22.
Iron and steel: Metal:				
Scrap	3,575	5,701	3	Taiwan 2,830; Japan 2,770.
Semimanufactures:				
Tubes, pipes, fittings	167,268	167,673	81,377	Hong Kong 24,337; China 17,663; United Arab Emirates 15,677.
Unspecified	20,620	64,333	506	China 50,679; Hong Kong 7,809.
Lead:				
Ore and concentrate	46,788	54,110	--	Japan 28,052; Belgium-Luxembourg 8,647; Australia 8,500.
Metal including alloys, all forms	27	213	--	Mainly to Japan.
Manganese: Oxides kilograms	--	295	--	Indonesia 195; Hong Kong 100.
Silver:				
Waste and sweepings[2] do	35	158	--	Singapore 151.
Metal including alloys, unwrought and partly wrought troy ounces	2,411	32	--	All to Laos.
Tin:				
Ore and concentrate	--	426	--	Republic of Korea 262; Singapore 100.
Metal including alloys:				
Unwrought	19,838	15,029	911	Singapore 5,844; Japan 4,531; Netherlands 2,555.
Semimanufactures	61	4,090	540	Singapore 1,708; Japan 1,046.
Titanium: Ore and concentrate	--	1,700	--	All to Malaysia.
Tungsten: Ore and concentrate	1,142	922	522	West Germany 300.
Zinc:				
Ore and concentrate	1,480	110	--	Philippines 60; Republic of Korea 50.
Oxides	91	167	--	Japan 72; Singapore 54; Sri Lanka 34.
Metal including alloys, all forms	20,365	28,632	(3)	China 11,602; Japan 2,884; Philippines 2,575.
Other: Ashes and residues	7,556	8,879	--	West Germany 3,695; India 2,915; Japan 711.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Dust and powder of precious and semiprecious stones including diamond kilograms	500	2,667	--	Malaysia 2,200; Laos 450.
Grinding and polishing wheels and stones	22	54	2	Burma 32; Singapore 11.
Barite and witherite	213,869	79,680	35,000	Indonesia 26,134; Taiwan 8,407.
Cement	72,059	41,534	--	Bangladesh 13,300; Laos 10,350; Hong Kong 6,580.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Clays, crude	4,883	4,965	--	Taiwan 4,560.
Diamond:				
Gem, not set or strung carats	99,804	125,749	10,785	Hong Kong 45,814; Belgium-Luxembourg 27,360; Japan 21,143.
Unsorted do	148	7,943	--	Belgium-Luxembourg 7,278.
Diatomite and other infusorial earth	--	30	--	All to Taiwan.
Feldspar	35,198	46,064	--	Taiwan 40,105; Malaysia 5,517.
Fertilizer materials: Manufactured:				
Nitrogenous	--	800	--	All to Laos.
Unspecified and mixed	1	726	--	Saudi Arabia 500; Laos 200.
Fluorspar	199,640	137,619	(3)	Japan 60,320; Republic of Korea 34,800; U.S.S.R. 32,000.
Gypsum and plaster	906,267	1,317,372	--	Japan 443,248; Taiwan 277,140; Malaysia 149,406.
Precious and semiprecious stones other than diamond:				
Natural kilograms	105,016	100,135	4,694	Hong Kong 75,306; West Germany 6,210.
Synthetic do	1,493	7,412	1,152	Switzerland 2,259; Italy 1,857; India 860.
Salt and brine	61,548	54,489	47	Malaysia 42,456; Singapore 11,655.
Sodium compounds, n.e.s.:				
Carbonate, manufactured kilograms	200	26,600	--	All to Laos.
Sulfate, manufactured	386	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	360	177	--	Taiwan 170.
Worked	1,871	570	(3)	Bangladesh 425; Taiwan 74.
Dolomite, chiefly refractory-grade	2,316	--		
Gravel and crushed rock	1	1	--	All to Canada.
Limestone other than dimension	5,489	7,490	(3)	Malaysia 4,843; Bangladesh 2,500.
Quartz and quartzite	25,185	18,803	--	Japan 18,800.
Sand other than metal-bearing	298	8	--	Mainly to Laos.
Sulfur: Elemental, all forms	334	1,968	--	Philippines 1,854.
Talc, steatite, soapstone, pyrophyllite	2,889	2,364	--	Philippines 2,100.
Other: Slag and dross, not metal-bearing	3,467	4,656	--	West Germany 3,670.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	5,298	7,385	--	Indonesia 4,026; India 1,967.
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	3,667,445	5,570,666	4,778,765	Republic of Korea 615,108; Japan 156,270.
Kerosene and jet fuel do	391,075	472,117	--	Malaysia 14,962; Singapore 7,907; unspecified 448,301.
Lubricants do	287,271	5,022	--	Japan 1,615; Singapore 733; Indonesia 641.
Unspecified do	r1,078	1,937	1	Japan 991; Malaysia 440; Indonesia 378.

rRevised.
[1]Table prepared by Audrey D. Wilkes.
[2]Includes other precious metals.
[3]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	7,506	11,491	--	Malaysia 9,640; China 1,851.
Oxides and hydroxides	13,347	17,605	28	Japan 14,197; United Kingdom 1,684.
Metal including alloys, all forms	49,431	51,523	2,312	Australia 25,526; Canada 14,553.
Antimony:				
Ore and concentrate	3,700	3,002	--	All from Burma.
Metal including alloys, all forms	20	12	--	All from China.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Arsenic: Oxides and acids	61	79	--	China 40; France 39.
Chromium:				
Ore and concentrate	1,400	2,755	--	Philippines 2,650.
Oxides and hydroxides	413	419	66	West Germany 234.
Metal including alloys, all forms kilograms	2,556	129	33	Hong Kong 96.
Cobalt:				
Oxides and hydroxides	203	7	1	Belgium-Luxembourg 2; Canada 2.
Metal including alloys, all forms kilograms	312	229	4	West Germany 125; Japan 100.
Columbium and tantalum: Metal including alloys, all forms, tantalum do.	2	9	--	All from Japan.
Copper: Metal including alloys, all forms	26,998	26,946	39	Zambia 11,000; Japan 8,774; Philippines 2,732.
Gold: Metal including alloys, unwrought and partly wrought troy ounces	140,160	130,649	6,133	Singapore 58,423; Japan 46,458.
Iron and steel: Metal:				
Scrap	657,950	555,114	64,350	Taiwan 220,206; Japan 58,538; Republic of Korea 47,000.
Pig iron, cast iron, related materials	18,600	16,910	11	Indonesia 9,000; Brazil 4,066; Japan 3,491.
Ferroalloys:				
Ferrochromium	242	197	--	Sweden 133.
Ferromanganese	4,015	2,980	--	Australia 1,357; France 1,078.
Ferronickel	(2)	--		
Ferrosilicomanganese	1,644	2,265	--	Australia 1,021; Philippines 680; Norway 484.
Ferrosilicon	3,967	3,525	3	Norway 2,302; France 587; China 470.
Silicon metal	13	9	--	Norway 8.
Unspecified	1,274	515	6	Australia 240; France 92; Japan 51.
Steel, primary forms	581,514	430,325	(2)	Brazil 84,562; Republic of Korea 82,644; Venezuela 50,241.
Semimanufactures thousand tons	1,451	1,194	15	Japan 813; Brazil 108.
Lead:				
Oxides	514	393	--	Australia 284; West Germany 60.
Metal including alloys, all forms	9,455	10,934	259	Australia 5,313; Japan 2,300; Burma 1,201.
Magnesium: Metal including alloys, all forms	54	59	(2)	Japan 24; France 23.
Manganese:				
Oxides	132,360	933	--	Japan 410; China 247.
Metal including alloys, all forms	16	10	--	United Kingdom 6; Switzerland 2.
Mercury 76-pound flasks	251	402	--	Japan 300; West Germany 78.
Nickel: Metal including alloys, all forms	1,095	1,111	22	Canada 426; Republic of Korea 322.
Platinum-group metals: Metals including alloys, unwrought and partly wrought troy ounces	193	1,897	--	Japan 1,575.
Silver:				
Ore and concentrate[3]	141	100	--	All from China.
Metal including alloys, unwrought and partly wrought thousand troy ounces	3,018	2,313	154	Australia 992; West Germany 522; Hong Kong 181.
Tin: Metal including alloys, all forms	12	11	(2)	Japan 8.
Titanium:				
Ore and concentrate	1,887	485	--	Australia 477.
Oxides	1,828	1,708	37	Australia 544; Japan 493; Belgium-Luxembourg 318.
Tungsten: Metal including alloys, all forms	5	4	(2)	Japan 1; United Kingdom 1.
Zinc:				
Oxides	429	376	(2)	Taiwan 210; Japan 111.
Blue powder	15	70	--	United Kingdom 40; Norway 30.
Metal including alloys:				
Unwrought	13,968	4,695	15	Australia 4,099.
Semimanufactures	345	340	(2)	Japan 96; West Germany 74; Australia 36.
Other: Ores and concentrates	5,344	2,221	--	Phillippines 1,000; Malaysia 557; China 450.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	2,470	1,997	5	Netherlands 1,050; India 513.
Artificial:				
Corundum	733	40	(2)	Italy 39.
Silicon carbide	448	605	(2)	Switzerland 221; West Germany 156; China 120.
Dust and powder of precious and semiprecious stones including diamond kilograms	27	2,905	61	Belgium-Luxembourg 2,831.
Grinding and polishing wheels and stones	1,738	1,388	8	Japan 441; Taiwan 369; China 168.
Asbestos, crude	71,516	49,663	8,396	Canada 24,253; Greece 3,680.
Boron materials: Oxides and acids	242	181	155	West Germany 26.
Cement	2,133	3,486	--	Japan 2,158; France 1,152.
Chalk kilograms	91,206	1,725	1,703	Japan 22.
Clays, crude	18,149	28,254	11,007	Indonesia 8,330; China 2,155.
Diamond:				
Gem, not set or strung carats	134,235	261,773	31,745	India 159,227; Belgium-Luxembourg 35,931.
Industrial stones do	12,965	7,255	--	Belgium-Luxembourg 3,803; Ghana 3,003.
Unsorted do	318,261	510,168	994	India 210,612; Belgium-Luxembourg 115,278; Ghana 103,222.
Diatomite and other infusorial earth	36	153	53	China 100.
Feldspar, fluospar, related materials:				
Feldspar	1,197	530	--	Japan 387; Italy 130.
Fluorspar	101	392	--	Japan 180; Canada 74; Italy 63.
Unspecified	314	200	--	Italy 105; Canada 93.
Fertilizer materials: Manufactured:				
Ammonia	2,890	5,506	(2)	Malaysia 4,308; Indonesia 536.
Nitrogenous	447,947	446,554	10,000	Japan 298,192; West Germany 33,723; Republic of Korea 28,990.
Phosphatic	1,000	500	--	Netherlands 400; China 100.
Potassic	42,018	62,970	3,511	U.S.S.R. 28,864; West Germany 10,565; Canada 8,202.
Unspecified and mixed	694,393	808,341	78,846	Republic of Korea 317,458; Norway 88,000; Romania 80,918.
Graphite, natural	722	827	--	China 297; Republic of Korea 270; Sri Lanka 109.
Gypsum and plaster	656	933	305	West Germany 401; Japan 118.
Iodine kilograms	2,803	3,022	100	Japan 2,250; West Germany 415.
Magnesium compounds:				
Magnesite, crude	6,329	5,916	--	Japan 1,674; unspecified 4,014.
Oxides and hydroxides	3,945	8,522	--	China 6,370; Japan 1,831.
Mica, all forms	184	210	16	India 115.
Phosphorus, elemental	34	35	--	China 15; West Germany 15.
Pigments, mineral:				
Natural, crude	192	155	9	China 120.
Iron oxides and hydroxides, processed	2,339	2,417	57	West Germany 1,667; Japan 313.
Precious and semiprecious stones other than diamond:				
Natural kilograms	152,886	273,974	33,750	Brazil 78,488; Burma 42,947; Australia 37,595.
Synthetic do	49,234	109,223	37,606	Taiwan 34,780; Switzerland 15,823.
Salt and brine	847	937	25	United Kingdom 560; West Germany 173.
Sodium compounds, n.e.s.:				
Carbonate, natural and manufactured	74,310	110,410	25,654	Romania 33,400; Kenya 19,500; Belgium-Luxembourg 15,386.
Sulfate, manufactured	22,644	27,440	4,613	China 14,485; Indonesia 4,360.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	3,486	1,868	(2)	Italy 1,081; Republic of Korea 297.
Worked	995	962	--	Italy 955.
Dolomite, chiefly refractory-grade	402	237	--	Norway 233.
Gravel and crushed rock	1,234	773	(2)	France 469; China 300.
Limestone other than dimension	18	(2)	--	All from Japan.
Quartz and quartzite	376	340	(2)	Italy 199; Hong Kong 60.
Sand other than metal-bearing	156	166	76	West Germany 48; Norway 36.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur:				
Elemental:				
Crude including native and by-product	54,857	59,895	(2)	China 24,291; Canada 18,662; Iran 11,545.
Colloidal, precipitated, sublimed	136	120	6	West Germany 76; Taiwan 38.
Dioxide	72	19	--	Singapore 12; Australia 7.
Sulfuric acid	9,083	3,047	(2)	Japan 2,998.
Talc, steatite, soapstone, pyrophyllite	18,888	22,117	67	China 12,318; Republic of Korea 9,000.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	3,223	4,105	68	China 1,130; Philippines 1,014; Taiwan 947.
Coal, all grades including briquets	282,694	182,584	(2)	Australia 70,413; Indonesia 69,531.
Coke and semicoke	48,031	39,115	--	China 18,825; Japan 17,039.
Petroleum:				
Crude thousand 42-gallon barrels	48,264	51,880	--	Malaysia 15,989; Brunei 11,263; Oman 10,126.
Partly refined do	2,010	1,807	16	Kuwait 1,237; China 318.
Refinery products do	19,181	17,795	45	Singapore 14,468; China 606.

[1]Table prepared by Audrey D. Wilkes.
[2]Less than 1/2 unit.
[3]May include other precious metals.

COMMODITY REVIEW

METALS

Antimony.—Mine output of antimony increased slightly from that of 1986 while production of antimony metal rose sharply owing to production from a new smelter, owned and operated by the state-owned New Siam Mineral Resources Co. Ltd., near Bangkok. The $1.7 million smelter, with an annual capacity of 1,000 tons of refined antimony, came on-stream in late 1986 and reportedly operated at near capacity. As a result, Thai antimony metal production reached a record-high level. Most antimony ore and metal produced in Thailand was for export.

According to the DMR, exports of antimony ore and metal for the first 9 months of 1987 were 2,439 tons and 289 tons, respectively, and were valued collectively at $2.1 million. The average export price of Thai antimony metal was $0.99 per pound in 1987. According to a local press report, production and exports of antimony metal in 1987 were expected to increase to more than 1,000 tons from 386 tons and to 900 tons from 267 tons, respectively. In 1987, most exports of antimony ore went principally to Belgium, Brazil, the Republic of Korea, Spain, and the United States and metal to Belgium, Malaysia, and Taiwan.

Columbium and Tantalum.—Construction of a new tantalum processing plant at Map Ta Put in the southeast of Rayong Province, 200 kilometers east of Bangkok, was postponed. According to Thailand Tantalum Industry Corp. (TTIC), the operating company, construction of the $35 million plant was originally scheduled to start in the first half of 1987 and be completed in mid-1990. The plant would have a capacity of 300 tons per year each of tantalum pentoxide and columbium pentoxide. However, the availability of tantalum extraction technology initially supplied by Hermann C. Starck to TTIC reportedly was still in question. An arbitration hearing for a final decision was scheduled for May 1988 in the Federal Republic of Germany. TTIC claimed that under the original agreement Starck, as a partner of the Phuket plant, was still obliged to supply the technology to TTIC. However, Starck was acquired by Bayer in 1986, and Bayer argued that the transfer agreement became invalid because the plant site was changed to Map Ta Put.[5]

Gold.—In October, the DMR invited international bids on five gold prospecting

and mining concessions in the Provinces of Prachinburi and Chonburi in central Thailand, where several potential gold deposits were discovered by the Government. According to guidelines drafted by the DMR, subject to approval by the Ministry of Industry, the successful foreign bidders must have Thai national participation, hire and train Thai geologists and engineers in each stage of prospecting and development, and be a member of the Mining Industry Council of Thailand with registered capital of no less than $2 million. Foreign companies expressing interest in gold prospecting and mining in Thailand reportedly included BHP Mineral Exploration Pty. Ltd., Euralba Mining Pty. Ltd., Pacific Arc Exploration Pty. Ltd., CHR Group Co., and CRA Exploration Pty. Ltd. from Australia; Placer Dome Inc. and Grand China Resources Ltd. from Canada; Malaysia Mining Corp. Bhd. from Malaysia; Kenmore Resources PLC from Ireland; Consolidated Gold Fields PLC from the United Kingdom; and Blue Mining Co. from the United States.[6]

To promote the local gem stone and jewelry industries and end smuggling of high-purity gold the Government, for the first time since 1979 lifted the gold import ban in October. In the process, Mocatta and Goldsmid, a London-based gold trader, was selected from among 14 bidders as Thailand's sole importer of gold bullion for consumption by the local jewelry industry. Under the first-year contract, Mocatta and Goldsmid was authorized to import 240,000 troy ounces of gold.

Lead.—Despite the improvement in the market price of lead, production of lead ore and concentrate decreased because of an 87% increase in royalty imposed by the Thai Government. Metallgesellschaft AG of the Federal Republic of Germany, 46% owner and operator of Thailand's largest lead mine, the Song Toh Mine in Kanchanaburi Province, reportedly asked the Government to lower the royalty to prevent mine production from further decline. In August, the Government reportedly agreed in principle to replace the fixed 10% royalty on metal content of the ore with a sliding scale of royalties on mined ore. For prices up to $319 per ton of lead metal, a minimum of 2% royalty will be charged. For prices higher than $797 per ton of lead metal, a maximum of 15% will be charged.[7]

In 1987, Thailand continued to export most of its lead ore and concentrate, principally to Japan and the Netherlands. Export earnings from lead were estimated at $9 million. The commissioning of Thailand's first 12,000-ton-per-year lead smelter, owned and operated by Thai Lead Metal Co. (TLM) in the western Province of Kanchanaburi and originally scheduled to come onstream in February, was postponed to April 1988. According to local press reports, allegations concerning air and water pollution from the smelter by local environmentalists caused further delay in opening the plant. TLM reportedly was installing additional pollution control facilities. Lead ore for the new smelter was to come from the Kleety Mine in Kanchanaburi Province near the Burmese border.

Tin.—Despite the improvement in tin market prices, Thai production and exports of tin continued to decline because of the Government's continuing continuing support of the ATPC effort to reduce the worldwide surplus of tin stocks. In early 1987, ATPC, including Thailand, agreed to limit tin exports and the Thai Government suspended the issue of tin mining licenses indefinitely. As a result, production of tin concentrate for the first 6 months of 1987 dropped 15% to 12,300 tons containing 9,000 tons of tin metal and exports of tin metal also dropped to 8,300 tons, down 15% from the same period in 1986.

Two major publicly owned tin mining companies, Aokam Thai Ltd. and Tongkah Harbour Ltd., both had suspended tin mining since April 1986, reportedly suffered severe losses for the first time in 1986 because of low tin prices and sales. However, in April 1987, two dredges of Aokam Thai and one dredge of Tongkah Harbour, with a combined capacity of 1,900 tons per year of concentrate, were put back into operation off Phuket. The action demonstrated Thailand's intention to meet its 1987 and future export quotas. The state-owned Offshore Mining Organization (OMO), which operated the Bo Dan dredge and received tin ore from satellite dredges and small operations, reported an increase in production and was operating profitably owing to a slight increase in tin market prices in 1987. In April, OMO reportedly applied to the Government for an additional mining tract off Phuket in the Kor Mai Ton area to increase production. If the concession is granted, OMO planned to operate its $14 million Bo Dan dredge at full capacity in the area during the monsoon season (May to September) and in its current concession in the Phangnga Bay area dur-

ing October to April.

Production of primary tin by Thailand Smelting and Refining Co. Ltd. (Thaisarco) in Phuket was less than 50% capacity because of insufficient tin concentrates from local miners during the first half of 1987. According to Thaisarco, the shortage was caused by the Government's delay in extending tax reductions on tin exports beyond June 3, 1987. To assist the tin industry following the October 1985 tin crisis, the Government had temporarily lowered business and municipal taxes to 1.1% from 4.4% until June 1987. In July, the Government finally approved a DMR proposal to extend the temporary tax reduction for another year.

For the first 6 months of 1987, exports of primary tin were 8,300 tons compared with 9,800 tons in 1986. They were valued at $55.2 million compared with $67.4 million in 1986. Thailand also exported 900 tons of tin concentrate valued at $3.8 million during the first half of 1987. In 1986, exports of primary tin totaled 18,567 tons and were valued at $116.4 million, accounting for 65% of Thai mineral export earnings. Under ATPC's agreement, the Thai export quota was 19,000 tons for 1987. The major buyers of Thai primary tin were Japan, the Netherlands, and Singapore.

Thai Pioneer Enterprise Co. Ltd., Thailand's second-largest tin smelter that came on-stream in March 1981 and shut down in May 1982, reportedly was expected to resume operations in 1988. The smelter, in Pathum, Thani Province, 40 kilometers north of Bangkok, has a capacity of 3,600 tons of primary tin. According to industry sources, the smelter has obtained permits to export 5,000 tons of primary tin for an unspecified period. However, it was still uncertain that there will be enough tin concentrate for the smelter to reopen in early 1988.

Zinc.—Despite increased production of slab zinc, exports of slab zinc dropped sharply because of increased domestic demand, largely by zinc alloy producers. To meet growing domestic demand for zinc and zinc alloy and to further reduce production costs, PDI, the operator of the 60,000-ton-per-year electrolytic zinc smelter at Tak, Tak Province, reportedly was expanding its capacity by 10,000 tons per year to 70,000 tons per year. Based on an estimate by PDI, production cost including all expenses and interest charges at the zinc refinery was $698 per ton in 1986. By November, PDI also completed a $1 million zinc alloy plant near the zinc refinery in Tak. It is capable of producing 5,000 to 6,000 tons per year of Zamag No. 3 zinc alloy. According to a company official, expansion of the refinery was scheduled for completion in late 1988, and the alloy plant was expected to start production in early 1988. PDI planned to export 50% of the plant's zinc alloy, principally to Hong Kong and Taiwan. For the first 6 months of 1987, PDI produced 32,660 tons of zinc slab compared with 27,778 tons in the same period of 1986. The required zinc ore and concentrate produced from the PDI-owned open pit at Mae Sot, Tak Province, 75 kilometers west of the zinc refinery, decreased slightly. According to the DMR, domestic consumption of refined zinc for the first 6 months of 1987 rose to 24,200 tons from 19,800 tons in 1986 while exports dropped to 9,100 tons from 20,500 tons in 1986. As a result, export earnings from refined zinc dropped to $7 million from $13 million for the first 6 months of 1986. However, zinc remained the second most important mineral and was the third-largest export-earning commodity in the nonfuel minerals sector.

In 1986, PDI made a net profit of $6.7 million on sales of $54.2 million. A further increase in net profit was expected for 1987 owing to the increased market price of zinc. As of December 31, 1987, PDI was owned 20% by the Ministry of Finance, 13.98% by Vieille-Montagne International S.A. (developer of the process technology) of Belgium, 13.52% by Mechim S.A. (designer and builder of the refinery) of Belgium, 10.66% by the state-owned Krung Thai Bank, 7.75% by the Industrial Finance Corp. of Thailand, 6.18% by Bangkok Bank Ltd., 3% by Mitsiam International Co. Ltd., 2.1% by the Goldhill Securities Co. Ltd., and the remainder by other and local investors.[8]

Other Metals.—Ilmenite, battery-grade manganese ore, and tungsten ore were other important metallic minerals produced in Thailand. Production of ilmenite, a by-product of tin mining in the Provinces of Phuket and Ranong, rose sharply to more than 22,000 tons from only 1,500 tons in 1986. The increase was due entirely to the strong demand of the pigment industry in the Asian region, especially Japan. An improved domestic market boosted production of battery-grade manganese ore slightly, while production of tungsten ore rose considerably because of increased exports to the Federal Republic of Germany and the United States.

INDUSTRIAL MINERALS

Barite.—Thailand was the third-largest producer of barite in the Far East, following China and India. However, because of decreased worldwide oil and gas exploration and the world's barite surplus, export markets for Thai barite remained depressed, especially in Indonesia, Saudi Arabia, and the United States. As a result, Thai production of barite dropped sharply in 1987. For the first 6 months of 1987, exports of crude barite dropped sharply to 19,333 tons from 58,600 tons in 1986, while exports of ground barite rose to 4,900 tons from 3,000 tons in 1986. Barite remained Thailand's eighth most valuable nonfuel mineral export commodity.

During 1986-87, barite was produced mainly by P & S Barite Mining Co. Ltd. in the Provinces of Loei and Tak and by American Tai Barite Ltd, a wholly owned subsidiary of NL Industries Inc. of the United States, in the Provinces of Chiang Mai and Surat Thani. P & S Barite produced both crude and ground barite for oil-well drilling while American Thai Barite produced chemical-, drilling-, and medical-grade barite. Most barite produced in Thailand was exported. Export earnings from barite dropped sharply to $3 million in 1986 from $8 million in 1985 owing to a 63% decline in exports of barite to Indonesia, Saudi Arabia, Singapore, and the United States.

Cement.—The cement industry continued to expand despite the growing surplus capacity and increased competition in the Far East regional market. In 1987, Siam City Cement Co. Ltd., Thailand's second-largest cement producer, completed and brought on-stream its new 1.8-million-ton-per-year plant at Tambol Tabkwang in Saraburi Province and increased the company's capacity to 4.6 million tons per year. According to industry sources, Thailand's cement capacity in 1987 are shown in table 4.

Cement production was estimated to have increased 24% to 9.9 million tons because of increased construction resulting from lower interest rates and improvement in the Thai economy in 1987. Exports of cement remained small in 1987.

Table 4.—Thailand: Cement production capacity in 1987

(Thousand metric tons)

Company and plant location	Capacity
Jalaprathan Cement Co. Ltd.:	
Takli	400
Cham-am	500
Siam Cement Co. Ltd.:	
The Luang, Ayuthaya	3,200
Thung Song, Nakhon Si Thammarat	900
Kaeng Khoi, Saraburi	3,300
Siam City Cement Co. Ltd.:	
Tambol Tabkwang, Saraburi	4,500
Total	12,800

Fertilizer Materials.—Construction of Thailand's first nitrogen and compound fertilizer complex at Map Ta Put in Rayon Province was postponed indefinitely owing primarily to further appreciation of the Japanese yen in 1987. The plant was to be built by a consortium led by Chiyoda Chemical and Engineering and Construction Co. of Japan and financed mostly by a yen loan. The low market price of urea and high cost of the domestic raw material, natural gas, reportedly were considered as other important negative factors for further delay. The project had been postponed seven times since 1985. According to National Fertilizer Corp., operator of the fertilizer complex, a letter of intent for construction of the second-stage compound fertilizer plants was awarded to a consortium led by Mitsui Engineering and Shipbuilding Co. Ltd. of Japan in mid-1987. The plans include a 63,000-ton-per-year monoammonium phosphate (MAP) plant and a 924,000-ton-per-year diammonium phosphate (DAP) plant.

In 1987, the Thai Polyphosphate and Chemical Co. was established to build an industrial-grade phosphoric acid plant in Samut Prakarn Province. The $10 million project, pending approval by the Thai Board of Investment, was a joint venture of Thai and Swiss private concerns. Albright and Wilson Ltd. of the United Kingdom reportedly would provide technical assistance. According to company plans, most output

would be consumed domestically with 25% exported.

In late 1987, a 14,000-square-kilometer potash exploration concession in the Sakon Nakhom Basin, 550 kilometers northeast of Bangkok, was awarded by the Ministry of Industry to BHP Utah International of the United States. Thai Agrico Potash Co., a Thai-United States joint venture exploring for potash in the same region, reportedly relinquished its concession in 1987 despite the earlier finding of potash in the region by Government geological surveys. The Thai Potash Co., a Thai-Australian joint venture, completed seismic surveys and commenced eight exploratory drillings in the Provinces of Khon Kaen and Maha Sarakam, 400 kilometers northeast of Bangkok. Thai Potash, established in 1984, was 70% owned by CRA Exploration Pty. Ltd. of Australia, 20% by Siam Cement Co. of Bangkok, and 10% by the Thai Government. Under an agreement with the Government, CRA Exploration was expected to offer 40% of its equity holding to the Thai public over an 8-year period 5 years after production started.[9]

Other Industrial Minerals.—Feldspar, fluorite, gypsum, and limestone were the other important industrial minerals produced in Thailand. Production of fluorite continued to decline because of reduced overseas demand and keen competition among world producers. However, production of feldspar and gypsum increased sharply owing to an 84% increase in exports of feldspar and a 90% increase in exports of gypsum. Feldspar was exported principally to Taiwan and Singapore while gypsum was exported mainly to Indonesia, Japan, the Republic of Korea, Malaysia, and Taiwan. Gypsum displaced slab zinc as Thailand's second most valuable nonfuel mineral export commodity in 1987. Production of limestone in the Provinces of Nakhon Sawan, Phetchaburi, Sara Buri, and Nakhon Si Thammarat increased owing to increased consumption by the domestic cement industry.

MINERAL FUELS

Lignite.—Lignite was produced mainly in two northern Provinces of Lampang and Lamphun and consumed principally by two coal-fired powerplants owned and operated by the Electricity Generating Authority of Thailand (EGAT). Production of lignite increased 25% to 7 million tons owing mainly to expanded capacity at the Mae Moh Mine in Lampang Province to meet the growing requirements of the EGAT Mae Moh powerplant and the Krabi powerplant in Krabi Province. About 80% of the Thai lignite production was consumed by the electric power industry and the remainder by the cement industry.

According to EGAT, lignite requirements for the existing and two additional units, 8 and 9, at Mae Moh powerplant would reach 9 million tons per year by 1990. Under EGAT's plan, three 300-megawatt generating units—Nos. 8, 9, and 10—are to be completed by 1991. Unit 8 was under construction and scheduled for completion in 1989. In early 1987, EGAT secured a $38.4 million loan from the Asian Development Bank for further expansion of lignite production capacity at the Mae Moh Mine for unit 9. During 1987, an additional 100 million tons of reserves reportedly were proven by EGAT in Songkhla Province in southern Thailand, making total reserves of 770 million tons, mostly in the Mae Moh area.

Natural Gas.—Production of natural gas rose sharply to 489 million cubic feet per day from 350 million cubic feet per day in 1986 owing to increased feedstock to a 350-million-cubic-foot-per-day gas separation plant in Map Ta Put, Rayong Province. About 94% of the output was produced by Unocal Thailand Ltd. from its offshore gasfields of Baanpot, Erawan, Platong, and Satun in the Gulf of Thailand. The remainder was produced as associated gas by Thai Shell Exploration and Production Co. Ltd. from its onshore oilfields of Sirikit and Sirikit West in Kamphaeng Phet Province.

Natural gas produced in Thailand was sold to state-owned PTT under gas sale agreements with the producers. PTT processed and distributed the gas to end users. EGAT, which operated six natural gas-fired thermal powerplants and gas turbine powerplants at South Bangkok in Samut Prakan, Bang Pakong in Chachoengsao, and Lan Krabue in Kamphaeng Phet, was the major end user. Other end users of natural gas in Thailand included manufacturers of cement, liquefied petroleum gas, and petrochemicals.

In March, an expansion program to increase capacity of the Map Ta Put gas separation plant was approved by the Government. According to PTT, the owner and operator of the plant, the $78 million program involved installation of an additional separation unit capable of processing 200

million cubic feet per day of natural gas. In June, PTT awarded a $4.7 million contract to Linde AG of the Federal Republic of Germany for process and engineering design, bid document preparation, bidder prequalification, and construction supervision. Bidding for construction of the plant was scheduled for January 1988, and construction was scheduled for completion in 1990.[10]

In August, PTT reached an agreement with Esso Exploration and Production Khorat Inc. after 3 years of negotiation to buy gas from Esso's Nam Phong Gasfield in Khon Kaen Province, 445 kilometers northeast of Bangkok. Under the agreement, Esso was expected to deliver initially 20 million to 40 million cubic feet per day of gas to a powerplant to be built by EGAT at Nam Phong. However, if gas reserves of 1.5 trillion cubic feet could be proven later, Esso would ultimately produce 250 million cubic feet per day of gas for delivery to PTT's central pipeline network. Development of the Nam Phong Gasfield was expected to be started by Esso in 1988.

In November, PTT also reached an agreement with TP of the United States after 10 years of negotiation to buy back from TP the right to the B-Structure Gasfield for $83.8 million. TP claimed to have invested $110 million on surveys and drilling 23 exploratory wells in the B-Structure concession since 1972. The gasfield, consisting of four offshore blocks and discovered by TP in the Gulf of Thailand in the mid-1970's, reportedly has proven reserves of 1.8 trillion cubic feet plus probable reserves of 5.4 trillion cubic feet. However, according to industry sources, because of geographically less concentrated gas deposits in the B-Structure concession, the development cost would be three to four times higher than more concentrated gas deposits. Several foreign companies including Unocal Thailand of the United States, Mitsui Oil Exploration of Japan, Statoil of Norway, and Total of France reportedly expressed interest in joint development with PTT of the gasfield.[11]

According to an official Thai estimate, proven recoverable natural gas reserves in Thailand at the end of 1987 were 3.7 trillion cubic feet plus 13.5 trillion cubic feet of probable reserves.

Petroleum.—Production of crude petroleum and natural gas condensate decreased to an average of 32,000 barrels per day from 35,000 barrels per day in 1986. Crude petroleum was produced by Thai Shell Exploration at its Sirikit and Sirikit West Oilfields in Kamphaeng Phet Province. Condensate was produced at Unocal Thailand's offshore gasfields including Baanpot, Erawan, Platong, and Satun in the Gulf of Thailand. The average output of crude petroleum and condensate in 1987 was 16,700 barrels per day and 15,200 barrels per day, respectively. Surplus condensate produced by Unocal Thailand was exported principally to the United States and Taiwan.

Thai Shell completed development of Thailand's first offshore oilfield, Nang Nuan in the center of the Gulf of Thailand, and was expected to commence production at an initial rate of 6,000 barrels per day in early 1988. Thai Shell's estimate of oil reserves in the field were 16 million barrels. In mid-1987, BP Petroleum Development Ltd. reportedly discovered oil in its Central Plains blocks southwest of Suphan Buri. According to BP officials, further analyses of the test results were necessary for development of the oilfield. Exploration for oil and gas increased considerably owing to improvement in world oil prices. In 1987, 48 exploratory wells were drilled compared with 26 in 1986. According to an official estimate, Thailand's proven recoverable oil reserves were 99 million barrels of proven reserves plus 415 million barrels of probable reserves.

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[1]Economist, Division of International Minerals.
[2]Where necessary, values have been converted from Thai baht (B) to U.S. dollars at the rate of B26.27 = US$1.00 in 1986 and B25.08 = US$1.00 in 1987.
[3]Far Eastern Economic Review (Hong Kong). V. 139, No. 3, Jan. 21, 1988, p. 69.
[4]Petroleum News (Hong Kong). News Supplement. V. 18, No. 3, June 1987, p. 1.
[5]The Rare Metal News (Tokyo). No. 1430, Dec. 16, 1987, p. 1.
Metals Week. V. 58, No. 49, Dec. 7, 1987, p. 6.
[6]Business Review (Bangkok). V. 16, No. 185, Sept. 1987, p. 49.
[7]Metal Bulletin (London). No. 7213, Aug. 24, 1987, p. 7.
[8]Padaeng Industry Co. Ltd. Annual Report 1987. P. 3.
[9]Fertilizer International. No. 257, Jan. 1988, p. 5.
[10]Oil and Gas Journal. V. 85, No. 12, Mar. 23, 1987, p. 32; v. 85, No. 25, June 22, 1987, p. 27.
[11]Far Eastern Economic Review (Hong Kong). V. 138, No. 45, Nov. 5, 1987 p. 85; v. 138, No. 48, Nov. 26, 1987, p. 84.
The Asian Wall Street Journal (Hong Kong). V. 12, No. 42, Oct. 28, 1987, p. 3.

The Mineral Industry of Tunisia

By Kevin Connor[1]

In general, economic conditions improved considerably for Tunisia in 1987. Although imports rose an estimated 3% in value, exports increased an estimated 27%, mainly due to improvements in crude petroleum and agricultural exports, caused by record-high harvests and higher oil prices. Total export receipts covered an estimated 74% of the country's import costs, up from only a 60% coverage in 1986. A 10% devaluation of the dinar, coupled with public spending cuts, caused the overall balance of payments to swing into a surplus condition. The country's growth in the overall gross national product was estimated at 5.8% for 1987.

Performance within the industrial minerals sector was mixed for the year. Tunisia's only major mineral contribution to world mineral supplies in 1987 continued to be phosphate rock and chemical fertilizers. Production of crude petroleum, Tunisia's most valuable mineral commodity, was down noticeably from the production levels of 1986. Production of steel and cement construction products was up again for another year, although mining output for most other minerals, excluding phosphate rock, was down slightly. The phosphate-based fertilizer industry showed an appreciable upturn in production, setting an all-time high. However, owing to stagnant fertilizer prices and the weakening of the U.S. dollar in which phosphates were internationally traded, there was an overall loss in export receipts. Exhaustion of deposits, and antiquated equipment continued to plague the iron ore and lead-zinc mining operations within the country.

Two Government agencies were responsible for nearly all of the nonpetroleum mineral production in Tunisia in 1987. These were the Compagnie des Phosphates de Gafsa (CPG), which consisted of eight phosphate mining operations, and Société Tunisienne d'Expansion Minière, which controlled five lead-zinc ore mines, one iron ore, and two barite and fluorspar operations. The combined labor force of these 2 agencies, which excludes limestone operations for cement manufacture, was estimated at over 19,000 persons, approximately 70% of which were miners.

Government Policies and Programs.—New petroleum exploration legislation went into effect during March. The new code was designed to encourage further foreign exploration programs in areas of Tunisia where small oil and gas fields have been discovered. Owing to their limited size, these fields have not been commercially developed. The new legislation was to charge royalties and other taxes based on ratios of profits to expenses for the international partners involved.

PRODUCTION AND TRADE

Output of important industrial minerals, excluding phosphate, was down slightly to moderately in 1987. Crude oil production was approximately 5%, or 2 million barrels less than that of 1986. The decrease was due to declines in production from the country's two main producing fields, El Borma in the southwest, which accounted for 65% of the production, and the offshore Ashtart Field, which accounted for most of the remainder.

For the third year in a row, Tunisian exports of cement rose dramatically. Ce-

ment exports increased by approximately 300% over those of 1986 and reached almost 600,000 tons.

Phosphate rock production increased 7% over that of 1986. The fertilizer sector had mixed results. Production of monoammonium phosphate approximately doubled, while triple superphosphate production was up moderately. Small declines or stagnant conditions were recorded for the production of phosphoric acid, diammonium phosphate, and dicalcium phosphate. Owing to continuing equipment problems and exhaustion of economic deposits, output of iron ore and lead and zinc concentrates was down slightly. Drawn steel products were down slightly, but the remaining steel subsectors—castings, rolled products, and steel structures—showed growth. Along with the increased demand for industrial steel goods, the strong demand for cement exports caused total cement sales to surge 13% over those of 1986.

Major mineral trading between Tunisia and the United States was limited to crude petroleum exports to the United States. Tunisia imported little or no mineral raw materials from the United States, although the United States continued to be a major supplier of heavy equipment to Tunisia. Exploration by U.S. petroleum companies continued to constitute the largest category of U.S. investment in Tunisia.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Iron and steel:					
Iron ore and concentrate, gross weight thousand tons	316	308	306	311	300
Metal:					
Pig iron do	147	150	e150	150	150
Steel, crude do	163	169	170	181	180
Lead:					
Mine output, Pb content	4,570	4,056	2,484	1,930	2,000
Metal:					
Primary[3]	10,398	8,400	2,040	2,208	2,200
Secondary[e]	500	500	500	500	500
Total[e]	10,898	8,900	2,540	2,708	2,700
Silver metal, primary thousand troy ounces	90	85	26	50	50
Zinc, mine output, Zn content	7,548	6,660	5,580	4,488	4,500
INDUSTRIAL MINERALS					
Barite	20,250	12,100	20,000	15,718	20,000
Cement, hydraulic thousand tons	2,850	2,777	3,070	2,984	3,400
Clays, construction[e] do	350	350	350	350	350
Fluorspar, chemical- and metallurgical-grade	34,013	44,510	42,240	36,828	40,000
Gypsum[e]	80,000	85,000	90,000	100,000	100,000
Lime thousand tons	580	600	e600	650	650
Phosphate rock, gross weight do	5,924	5,346	4,530	5,951	46,390
Salt, marine do	375	330	382	415	420
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural:					
Gross[e] million cubic feet	28,000	28,000	28,000	28,000	28,000
Marketed do	14,503	14,080	14,000	14,000	14,000
Petroleum:					
Crude thousand 42-gallon barrels	42,649	42,251	41,000	42,000	40,000
Refinery products:					
Gasoline do	1,546	1,794	e1,800	e1,800	1,800
Kerosene do	2,085	2,402	e2,400	e2,400	2,400
Distillate fuel oil do	2,988	3,156	e3,000	e3,000	3,000
Residual fuel oil do	3,937	3,936	e4,000	e4,000	4,000
Other do	460	394	e400	e400	400
Refinery fuel and losses do	235	160	e200	e200	200
Total do	11,251	11,842	e11,800	e11,800	11,800

[e]Estimated. [p]Preliminary.

[1]Table includes data available through June 9, 1988.

[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. Limestone quarried for cement manufacture is substantial; however, information is inadequate to make accurate estimates of output.

[3]From domestic and imported ores.

[4]Reported figure.

Table 2.—Tunisia: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1986	Destinations, 1986	
		United States	Other (principal)
METALS			
Aluminum:			
Oxides and hydroxides	46	--	All to Algeria.
Metal including alloys:			
Scrap	559	--	France 205; Italy 166; United Kingdom 72.
Semimanufactures	1,641	(2)	Algeria 1,621; France 20.
Copper: Metal including alloys, scrap	1,051	--	Spain 673; France 288.
Iron and steel:			
Iron ore and concentrate excluding roasted pyrite	3,025	--	All to Netherlands.
Metals:			
Scrap	1,457	--	Italy 1,343.
Steel, primary forms	765	--	All to Italy.
Semimanufactures:			
Bars, rods, angles, shapes, sections	57	--	Algeria 55.
Universals, plates, sheets value, thousands	$4,046	--	Algeria $4,005; United Kingdom $41.
Hoop and strip	10	--	All to Austria.
Wire	499	--	Alteria 350; West Germany 149.
Tubes, pipes, fittings value, thousands	$15,106	$1	Algeria $12,088; United Arab Emirates $2,730.
Lead:			
Ore and concentrate	3,000	--	All to France.
Oxides	335	--	All to Algeria.
Metal including alloys, scrap	588	--	Italy 329; West Germany 259.
Magnesium: Metal including alloys, scrap	14	--	All to Belgium-Luxembourg.
Zinc:			
Ore and concentrate value, thousands	$713	--	United Kingdom $432; Yugoslavia $238.
Metal including alloys, scrap	20	--	All to Italy.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.: Grinding and polishing wheels and stones	5	--	All to Algeria.
Cement	272,027	--	Cameroon 182,515; Spain 60,118.
Diamond: Gem, not set or strung value, thousands	$6,738	--	All to Belgium-Luxembourg.
Feldspar, fluorspar, related materials	6,100	--	All to Italy.
Fertilizer materials: Manufactured:			
Nitrogenous	32,998	--	France 23,829; United Kingdom 3,728; Netherlands 2,750.
Phosphatic	1,335,683	--	China 256,458; France 185,328; Italy 184,640.
Phosphates, crude thousand tons	1,206	--	Romania 278; Greece 179; France 168.
Salt and brine	359,568	--	Italy 145,674; Brazil 96,210; Norway 28,620.
Stone, sand and gravel:			
Dimension stone, worked value, thousands	$2	$2	
Quartz and quartzite	1	--	Mainly to France.
Sand other than metal-bearing	15	--	Spain 7; France 3.
Other: Slag and dross, not metal-bearing	1,024	--	All to Italy.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude thousand 42-gallon barrels	28,714	535	Italy 9,861; Greece 4,411; France 4,121.
Refinery products:			
Gasoline, motor 42-gallon barrels	518,602	--	Netherlands 314,441; unspecified 204,161.
Kerosene and jet fuel do.	35,263	--	All for bunkers.
Distillate fuel oil do.	1,488,357	--	France 638,154; Netherlands 265,721; Mozambique 166,560.
Lubricants do.	84	28	NA.
Bituminous mixtures do.	18	--	All to Algeria.

NA Not available.

[1]Table prepared by Viginia A. Woodson. Data for 1985 were not available at the time of publication.

[2]Unreported quantity valued at $4,000.

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

(Metric tons unless otherwise specified)

Commodity	1986	Sources, 1986	
		United States	Other (principal)
METALS			
Alkali and alkaline-earth metals	1	--	All from France
Aluminum:			
Oxides and hydroxides	26,859	NA	Italy 19,696; France 7,158.
Metal including alloys:			
Unwrought	1,956	--	Canada 1,735; Greece 200.
Semimanufactures	2,640	(2)	Italy 791; Austria 389; Belgium-Luxembourg 366.
Chromium: Oxides and hydroxides	27	--	West Germany 16; Belgium-Luxembourg 5.
Cobalt: Oxides and hydroxides	1	--	Mainly from Spain.
Copper:			
Matte and speiss including cement copper	96	--	All from Italy.
Metal including alloys:			
Scrap	2	--	All from France.
Unwrought	316	--	Italy 304; France 10.
Semimanufactures	7,438	NA	France 4,726; Belgium-Luxembourg 1,391.
Iron and steel:			
Iron ore and concentrates excluding roasted pyrite	70,689	--	Morocco 57,284; Mauritania 13,405.
Metal:			
Scrap	537	100	Netherlands 300; France 137.
Pig iron, cast iron, related materials	1,422	2	West Germany 739; Brazil 500.
Ferroalloys:			
Ferromananese	370	--	All from France.
Unspecified	1,364	--	Yugoslavia 500; Norway 310; Venezuela 250.
Steel, primary forms	38,382	--	Spain 38,365.
Semimanufactures:			
Bars, rods, angls, shapes, section	104,072	(3)	Spain 37,914; Romania 22,121; France 9,213.
Universals, plates, sheets	110,625	(4)	Italy 28,019; France 22,670; West Germany 17,274.
Hoop and strip	3,544	--	France 2,183; Italy 708.
Rails and accessories	243	--	Bulgaria 78; France 57; Portugal 31.
Wire	2,576	NA	France 1,053; Belgium-Luxembourg 500; Italy 459.
Tubes, pipes, fittings	17,912	442	France 8,666; Italy 4,138; Japan 1,949.
Castings and forgings, rough	59	--	Spain 44; Italy 13.
Lead:			
Oxides	115	--	Italy 40; France 24; West Germany 20.
Metal including alloys:			
Unwrought	2,709	--	Morocco 1,210; Mexico 948; Peru 350.
Semimanufactures	9	--	France 8.
Magnesium: Metal including alloys, semimanufactures	4	--	United Kingdom 3; France 1.
Manganese:			
Ore and concentrate, metallurgical-grade	155	--	Gabon 115; France 40.
Oxides	103	--	France 47; West Germany 27; Belgium-Luxembourg 25.
Mercury, 76-pound flasks	319	--	Algeria 290; France 29.
Molybdenum: Metal including alloys, all forms, value, thousands	$18	--	Austria $9; Sweden $7.
Nickel:			
Matte and speiss, do.	$2	--	All from United Kingdom.
Metal including alloys, semimanufactures	90	--	United Kingdom 52; France 18.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, value, thousands	$30	--	Belgium-Luxembourg $25; West Germany $4.
Silver: Metal including alloys, unwrought and partly wrought, do.	$70	--	France $41; Italy $15; France $11.
Tin: Metal including alloys:			
Unwrought	36	--	Indonesia 17; United Kingdom 12.
Semimanufactures	19	--	West Germany 11; United Kingdom 4.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1986	Sources, 1986	
		United States	Other (principal)
METALS —Continued			
Titanium: Oxides	307	15	France 127; West Germany 110.
Tungsten: Metal including alloys, all forms value, thousands	$23	$4	West Germany $13; France $6.
Zinc:			
Oxides	375	--	France 136; Belgium-Luxembourg 127; West Germany 70.
Metal including alloys:			
Unwrought	2,271	--	Algeria 954; Italy 424; France 404.
Semimanufactures	334	--	Spain 144; Italy 118; France 54.
Other:			
Ores and concentrates	60	--	All from Italy.
Oxides and hydroxides	131	41	Belgium-Luxembourg 36; West Germany 25.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc	708	--	Turkey 188; Italy 144; United Kingdom 138.
Artificial: Corundum	183	--	Italy 103; France 58.
Dust and powder of precious and semiprecious stone including diamond value, thousands	$43	--	Belgium-Luxembourg $42.
Grinding and polishing wheels and stones	177	NA	Italy 94; France 30.
Asbestos, crude	9,207	--	Canada 4,630; Zimbabwe 2,031.
Barite and witherite	90	--	All from France.
Boron materials: Oxides and acids	48	--	France 42; West Germany 6.
Cement	60,272	2	France 46,199; Belgium-Luxembourg 8,568.
Chalk	2,354	--	France 1,932; Italy 397.
Clays, crude	34,932	78	Italy 9,673; France 7,892; United Kingdom 6,046.
Diamond: Gem, not set or stung value, thousands	$11,255	--	Belgium-Luxembourg $10,615.
Diatomite and other infusorial earth	167	--	All from France.
Feldspar, fluorspar, related materials	8,190	--	Spain 3,756; Suriname 2,878.
Fertilizer materials: Manufactured:			
Ammonia	203,801	62,790	Bahrain 58,878; U.S.S.R. 31,014; Kuwait 19,010.
Nitrogenous	8,169	--	Italy 4,325; Bulgaria 1,880; Egypt 1,300.
Phosphatic	150	--	All from Italy.
Potassic	15,021	--	East Germany 5,500; Belgium-Luxembourg 3,000; Jordan 2,700.
Unspecified and mixed	75	--	France 30; Belgium-Luxembourg 25; West Germany 20.
Graphite, natural	1	--	All from France
Gypsum and plaste	519	--	Do.
Lime	131	--	Do.
Magnesite	480	--	Greece 291; Netherlands 72.
Mica:			
Crude including splittings and waste	13	--	All from Canada.
Worked including agglomerated splittings value, thousands	$9	--	France $6; Austria $2.
Phosphates, crude do	$1	--	All from France.
Pigments, mineral: Iron oxides and hydroxides, processed	168	--	West Germany 53; Netherlands 51; Belgium-Luxembourg 27.
Precious and semiprecious stones other than diamond:			
Natural value, thousands	$5	--	West Germany $4; Saudi Arabia $1.
Pyrite, unroasted	10	--	All from Italy.
Salt and brine	71	--	West Germany 62; United Kingdom 6.
Sodium compounds, n.e.s.:			
Carbonate, manufactured	6,299	--	Italy 3,401; France 1,752.
Sulfate, manufactured	33,496	--	Spain 18,015; France 11,442.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	19,080	--	Italy 15,045; Turkey 2,327.
Worked	564	--	Italy 559.
Dolomite, chiefly refractory-grade	509	--	France 399; Spain 100.
Gravel and crushed rock	47,372	--	Italy 26,253; Greece 20,963.
Quartz and quartzite	925	--	Belgium-Luxembourg 836; France 55.
Sand other than metal-bearing	1,104	11	Belgium-Luxembourg 1,053.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1986	Sources, 1986	
		United States	Other (principal)
INDUSTRIAL MINERALS —Continued			
Sulfur:			
Elemental:			
Crude including native and byproduct thousand tons	1,096	338	Canada 323; Saudi Arabia 104.
Colloidal, precipitated, sublimed	48	--	West Germany 46; Italy 2.
Sulfuric acid	46	--	France 30; Sweden 14.
Talc, steatite, soapstone, pyrophyllite	1,044	--	France 610; Spain 301; Italy 115.
Other: Crude	9	--	France 4; China 3.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	7	1	France 6.
Carbon black	1,595	--	Italy 1,079; France 252.
Coal:			
Anthracite and bituminous	12,258	--	France 10,510; Morocco 1,748.
Lignite including briquets	4	--	All from West Germany.
Coke and semicoke	81,153	--	West Germany 48,628; Italy 20,901; Algeria 11,616.
Peat including briquets and litter	1	--	All from France.
Petroleum refinery products:			
Gasoline, motor 42-gallon barrels	26	--	West Germany 17.
Mineral jelly and wax do.	6,941	--	France 3,927; West Germany 2,487; Hungary 260.
Kerosene and jet fuel do.	702,414	--	Italy 288,323; Greece 216,752; Kuwait 111,507.
Lubricants do.	24,682	(5)	France 7,924; Italy 5,579; West Germany 3,738.
Residual fuel oil do.	5,401,573	55,371	Spain 1,965,200; Italy 1,120,092; France 994,218.

NA Not available.
[1]Table prepared by Virginia A. Woodson. Data for 1985 were not available at the time of publication.
[2]Unreported quantity valued at $27,000.
[3]Unreported quantity valued at $7,000.
[4]Unreported quantity valued at $4,000.
[5]Unreported quantity valued at $5,000.

COMMODITY REVIEW

METALS

International companies were invited to bid on an estimated $10 million contract to upgrade one of the two rolling mills at Tunisia's only integrated steel plant, El Fouladh at Menzel Bourguiba. The wire-rod mill was to be expanded from a capacity of 75,000 tons to 130,000 tons per year. The Fouladh complex operated at full capacity, producing approximately 190,000 tons of finished product in 1987, but was still unable to meet local demand. Planning continued for modifying the electric arc furnace at the complex to increase capacity. Owing to budget difficulties, plans to build a second integrated steel complex for Tunisia have been set back.

INDUSTRIAL MINERALS

Cement.—The newly commissioned white cement plant at Feriana, near the Algerian border, began production operations at the very end of 1987. The plant was owned and operated by the Société Tuniso-Algerienne de Ciment Blanc, a joint venture operation between Algeria and Tunisia, and financed jointly by both Governments. This is the first industrial project to be entered into between these two countries, and was also the first white cement plant built in North Africa. The 210,000-ton-per-year plant was built by Creusot Loire Entreprise of France on a turnkey contract basis for $119 million.[2] Output from the plant was expected to cover all local needs, Algerian needs, and provide 20,000 to 30,000 tons for export. The plant product was to be transported by truck approximately 20 miles to an existing Algerian railroad line in 1988. Construction of a railroad link between the plant complex to the existing rail line was expected to get underway before mid-1988.

Fertilizer Materials.—After a thorough investigation during the early 1980's by Tunisia's Société Industrielle d'Acide Phosphorique et d'Engrais (SIAPE), the folded-bed chemical separation process (FBCSP) was selected for use in a magnesium-removal demonstration plant to be built at Sfax. Developed by American Pembroke Inc. and Swenson Process Equipment Inc.,

both of the United States, the plant was commissioned in September 1986. The results of the first 6 months of nonstop operations were made public in midyear 1987.

Local reserves of high-magnesium-content phosphate rock have been known to be in existence in the Sfax area for some time. However, the high magnesium content of the rock had prevented any development. The magnesium problem as assessed had to be dealt with, either through the improved beneficiation of the phosphate rock or through processing of the downstream phosphoric acid. Employing the FBCSP process was an attempt at the latter solution. The process uses an ion-exchange resin to remove magnesium and, coincidentally, calcium from filter-grade phosphoric acid.

The demonstration plant, with a capacity of 13,000 tons per year of P_2O_5, was adjacent to SIAPE's phosphoric acid plants at Sfax. The plant was designed and built by Swenson and Spie Batignolles S.A. of France. Swenson, as exclusive process licensor, provided the crucial engineering, while Spie Batignolles provided detailed engineering and construction of the plant. The plant took 16 months to design and build and was initially completed late in 1985, although problems delayed the commissioning until the latter half of 1986. Initial testing results at the plant were positive. However, consideration of full-scale use of the process in the Sfax area was to await further testing.

Also at Sfax and nearing completion of construction at yearend was the SIAPE 2. The complex was expected to come on-line in January 1988. Estimated production of the plant at full capacity was 360,000 tons per year concentrated phosphoric acid and 330,000 tons per year of concentrated superphosphoric acid. The approximate cost of building the complex was $175 million. It was expected to employ 500 people.

MINERAL FUELS

Petroleum.—Petroleum company officials were in agreement that the petroleum legislation passed by the Tunisian Parliament in April offered immediate benefits that would deter international companies from pulling out of petroleum exploration ventures there. Income tax breaks and a better system for accessing royalty payments were two major concessions to the international partners. The new legislation also enticed new firms to come to Tunisia to explore for oil. Pan Ocean Oil Co. of Geneva, Switzerland, secured an exploration concession in the Sbeitla region. Partly as a result of the legislation, as many as 25 exploration wells were expected to be drilled by international companies in 1988. The Tunisian State Petroleum Agency, Entreprise Tunisienne d'Activités Petrolières (ETAP) was expected to drill as many as 12 wells in 1988, the same number spudded by ETAP in 1987.

Late in 1987, Azienda Generali Italiana Petroli S.p.A. of Italy made a discovery in its Enfida permit of Block 10 off the Tunisian coast. The well, Maamoura-1, flowed at 2,880 barrels per day of 38° API crude from depths of 2,486 meters and 2,506 meters. Another well in the area was being drilled at yearend. The Marathon Oil Co. (United States) completed three wells in its Zarsis permit during the year. The first two wells struck sizable quantities of oil, but the third proved dry. Additional seismic testing was done in the fourth quarter of 1987, and spudding of a fourth well was planned for the first quarter of 1988, the location of which was to be based on evaluation of the data underway at yearend. Marathon was also involved in two other concessions in 1987.

Pennzoil Tunisia Inc. of the United States completed a third well in October in its Didon-Elyssa permit of Block 16. Results were still being evaluated at yearend. Houston Oil & Minerals Corp. of Tunisia conducted drilling in its offshore Isis permit in 1987; the U.S.-based company planned to continue drilling throughout 1988.

Several other international firms planned major exploration programs to begin in 1988. The Kuwait Foreign Petroleum Exploration Co. planned to drill three or four wells in its Kairouan Nord and Kairouan Sud areas of Blocks 17 and 18. Drilling was underway at yearend by Elf Aquitaine Tunisie in its Kirchaou permit of Block 14. ETAP and Italy's Petrex were Elf's partners in this concession.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Tunisian dinars (D) to U.S. dollars at the rate of D0.78=US$1.00.

The Mineral Industry of Turkey

By Kevin Connor[1]

Turkey's economic growth was a healthy 7% over that of 1986, and rapid economic development was accompanied by a rising demand for raw materials, much of which was met through imports. Total imports increased 25% in value over 1986 levels to an estimated $10 billion.[2] However, exports increased substantially and were also valued at an estimated $10 billion. The domestic economy continued to suffer from high inflation with an estimated 50% increase over that of 1986.

Turkey continued with its energy policy of using a diversity of supplies, with emphasis on domestic sources. With only small known domestic oil reserves, and large lignite coal deposits available, considerable investments were underway during the year to increase coal production. Lignite coal-fired powerplants at nine locations generated one-half of Turkey's total electrical demand of approximately 4 billion watts. The iron and steel industry and the cement industry were major consumers of coal, and both industries continued to grow rapidly throughout the year. These combined market sectors were the driving force behind the rapid expansion of the coal mining sector in Turkey in 1987.

Excluding oil and gas reserves, it was estimated in 1987 that Turkey had approximately 4,000 mineral deposits. Despite the large variety of mineralization, most of Turkey's deposits were not classified as large by world standards. Boron, chromium, copper, iron, lead, mercury, and zinc were some of the more important of the 29 different kinds of minerals that were being exploited commercially at yearend.

Etibank, the Turkish state-owned mining company, has 19 mining, chemical, and metallurgical establishments; 2 subsidiaries; 5 joint-venture participations; and 41 different products, which included alumina, barite, bauxite, chromite ores and concentrates, diaspore, emery, perlite, phosphate, and sulfur.

Government Policies and Programs.—Late in 1987 the Government announced plans to resume tariff cuts under the European Economic Community (EEC) Association Agreement of 1972. Renewing the tariff cuts was expected to help Turkey in its application to become a full member of the EEC.

PRODUCTION AND TRADE

Turkish iron and steel products were the second largest export earner for the country, after textiles, earning almost $1 billion in 1987. This sector has shown steady and dramatic increases since 1980, when the total export value was $34 million. The products, chiefly rebars, profiles, sheets, plates, and welded pipes, were shipped to more than 40 countries, including China, the U.S.S.R., the United States, and the EEC. The growing steel export industry was a major concern to international trade authorities, and Turkey has agreed to fix minimum prices to avoid dumping allegations. With production of iron and steel products expected to increase another 45% in the next few years, steel trading was a major point of discussion in Turkey's bid for EEC membership. In order of export importance, the iron and steel sector was followed by the boron industry, ferrochrome and chromium, and the magnesite industry. In

order of total value, cement and coal production ranked second and third, respectively, after steel in 1987; however, few of these products were exported.

Exports by the state mining agency, Etibank, were valued at approximately $230 million for the year. Boron and its concentrates remained Turkey's main industrial mineral export in 1987, with export revenues estimated at $185 million, or almost 80% of all Etibank's export receipts. Etibank continued to expand its facilities to process boron ore, to move marketable boron compounds, and to increase the value added of boron exports.

Turkey's crude oil production for 1987 was up 9.5% over that of 1986. Consumption far outstripped production again, as crude oil consumption was estimated at 200 million barrels, over 90% of which was met with imports. Crude imports continued to represent Turkey's largest single import item, accounting for 89.4% of Turkey's mineral import costs and 19.1% of its total import expenses. Crude oil imports increased 17% in volume over those of 1986, and owing to the improved market price for crude, the total cost rose a dramatic 50% to $2.7 billion. Far less significant, but worth noting, imports of cement rose dramatically, increasing from 71,000 tons in 1986 to 1,630,000 tons. Exports of cement rose only slightly to 1,365,000 tons.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
METALS					
Aluminum:					
Bauxite	306,360	131,568	213,744	290,712	246,541
Alumina	57,420	75,120	113,303	144,396	95,236
Al content	30,400	37,900	54,100	e50,000	e50,000
Antimony:					
Ore, mine output:					
Gross weight	27,901	35,525	34,312	32,943	49,614
Sb content[e]	840	1,017	982	943	1,488
Smelter	1,267	1,821	2,097	2,117	2,232
Regulus	198	42	15	28	412
Chromite:					
Gross weight (34% to 43% Cr_2O_3)	514,992	688,917	876,807	861,720	866,997
Salable product	345,610	487,405	588,576	543,156	e600,000
Copper:					
Mine output, gross weight	2,184,872	2,466,158	2,228,167	2,374,862	2,630,985
Cu content:					
Smelter	19,113	32,023	33,884	35,466	e35,000
Refined	r37,900	r51,400	60,600	75,100	e75,000
Iron and steel:					
Iron ore, gross weight thousand tons	4,151	4,037	3,994	5,249	3,366
Metal:					
Pig iron and ferroalloys:					
Ferrochromium	30,175	48,081	48,000	50,000	9,330
Ferrosilicon	4,500	6,902	6,900	7,000	4,400
Pig iron and other ferroalloys thousand tons	2,719	2,902	3,193	3,666	4,438
Steel, crude including castings do	3,834	4,330	4,961	5,376	7,044
Lead:					
Mine output, Pb content	r7,500	r9,000	10,000	--	--
Pb content, smelter, primary	2,000	--	--	--	--
Manganese ore, gross weight	3,204	42,796	10,750	7,106	e7,000
Mercury 76-pound flasks	4,680	5,272	6,552	7,574	5,847
Silver, mine output, Ag content[e] thousand troy ounces	220	220	220	220	220
Tungsten, W content of concentrate[e]	390	153	100	50	2262
Zinc:					
Mine output, Zn content	31,100	50,400	37,400	41,100	e58,000
Zn content, smelter, primary	14,300	19,900	22,200	15,400	e20,200
INDUSTRIAL MINERALS					
Abrasives, natural: Emery	22,846	21,145	15,648	e16,000	e16,000
Asbestos	1,510	1,499	932	1,098	e1,000
Barite	78,974	198,031	220,497	322,769	294,481
Boron materials thousand tons	702	895	954	928	e1,000
Cement, hydraulic do	13,595	15,738	17,581	20,004	21,980
Clays:					
Bentonite	31,000	28,093	46,855	55,367	85,848
Kaolin	55,000	54,932	69,390	78,430	134,114
Other	21,865	71,777	168,719	187,449	308,092
Total	107,865	154,802	284,964	321,246	528,054

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
INDUSTRIAL MINERALS —Continued					
Diatomite	9,600	2,540	[e]3,000	3,000	[e]3,000
Feldspar[e]	9,212	10,000	20,000	20,000	[2]30,336
Fluorspar[e]	2,000	2,000	2,000	2,000	2,000
Graphite	4,805	5,000	5,000	5,000	11,760
Gypsum	75,572	57,875	78,058	128,051	301,743
Lime thousand tons	1,000	1,000	1,000	1,100	1,100
Magnesite, crude ore	[r]626,563	[r]770,577	1,128,961	1,313,763	1,185,904
Meerschaum kilograms	8,850	15,000	16,800	9,600	10,095
Nitrogen: N content of ammonia	278,700	290,000	217,100	190,000	200,000
Perlite	28,693	60,452	60,000	60,000	111,423
Phosphate rock	50,400	95,600	37,400	3,000	19,200
Pyrites, cuprous, gross weight	4,238	---	26,032	10,153	30,909
Salt, all types thousand tons	1,261	1,290	1,189	1,172	1,218
Sodium compounds, n.e.s.:					
Carbonate[e]	120,000	200,000	300,000	350,000	375,000
Sulfate	61,942	83,026	108,665	145,702	[e]150,000
Sand and gravel, sand, siliceous[e]	110,000	110,000	110,000	110,000	110,000
Stone, sand and gravel, n.e.s.:					
Limestone thousand tons	343	350	350	350	405
Marble	39,110	40,000	40,000	40,000	70,000
Quartzite	239,201	240,000	318,450	429,921	552,462
Strontium minerals: Celestite[e]	38,835	35,000	35,000	35,000	35,000
Sulfates, natural, n.e.s.: Aluminum sulfate (alunite)	14,682	13,971	11,578	12,000	9,927
Sulfur:					
Native, other than Frasch	34,899	40,722	43,639	41,275	40,000
S content of pyrites[e]	1,830	---	11,250	4,390	13,350
Byproduct[e]	[r]75,000	78,000	80,000	80,000	80,000
Total[e]	111,729	118,722	134,889	125,665	133,350
MINERAL FUELS AND RELATED MATERIALS					
Asphalt, natural[e] thousand tons	750	750	750	750	750
Carbon black[e]	20,000	20,000	20,000	20,000	[2]33,141
Coal:					
Anthracite thousand tons	6,122	7,103	8,526	8,500	7,084
Bituminous do.	750	225	523	500	630
Lignite do.	23,847	27,199	35,833	36,000	46,149
Coke and semicoke:					
Metallurgical do.	2,380	2,401	2,400	2,400	2,912
Gashouse do.	121	100	100	100	105
Breeze do.	260	174	170	200	259
Total do.	2,761	2,675	2,670	2,700	3,276
Gas, natural:[e]					
Gross million cubic feet	27,000	27,000	27,000	27,000	27,000
Marketed do.	3,500	3,500	3,500	3,500	3,500
Petroleum:					
Crude thousand 42-gallon barrels	15,779	14,941	15,110	[e]17,097	[e]18,717
Refinery products:					
Asphalt do.	2,534	2,960	3,405	[e]3,500	[e]3,500
Distillate fuel oil do.	47,664	50,570	50,537	[e]50,000	[e]50,000
Gasoline do.	16,956	18,380	18,681	[e]19,000	[e]19,000
Jet fuel do.	2,263	2,472	2,875	[e]3,000	[e]3,000
Kerosene do.	2,375	2,593	3,585	[e]4,000	[e]4,000
Liquefied petroleum gas do.	4,865	5,585	5,379	[e]5,500	[e]5,500
Lubricants do.	1,563	1,486	1,174	[e]1,000	[e]1,000
Naphtha do.	226	58	205	[e]500	[e]500
Refinery fuel and losses do.	1,905	2,248	2,388	[e]2,500	[e]2,500
Residual fuel oil do.	34,178	38,433	37,962	[e]40,000	[e]40,000
Unspecified do.	7,532	9,787	8,271	[e]8,000	[e]8,000
Total do.	122,061	134,572	134,462	[e]137,000	[e]137,000

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

[1]Table includes data available through July 21, 1988. Limestone quarried for cement manufacture is substantial; however, information is inadequate to make accurate estimates of output levels.

[2]Reported figure.

Table 2.—Turkey: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1984	1985	Destinations, 1985	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals	5,950	--		
Aluminum:				
Ore and concentrate	46,845	52,870	--	All to France.
Oxides and hydroxides	16,846	22,648	5	Iraq 14,993; U.S.S.R. 7,650.
Metal including alloys:				
Scrap	14	--		
Unwrought	18	--		
Semimanufactures	25,110	25,437	4,844	Iraq 6,791; Iran 4,358; Kuwait 3,314.
Chromium:				
Ore and concentrate	439,680	478,069	30,122	Yugoslavia 84,205; Chile 91,468; Sweden 49,418.
Oxides and hydroxides	--	301	--	All to Iraq.
Copper: Metal including alloys:				
Unwrought	12	5,717	--	United Kingdom 3,199; Greece 900.
Semimanufactures	12,273	21,772	194	Iran 12,830; Iraq 8,266.
Iron and steel:				
Iron ore and concentrate including roasted pyrite	8,400	43,461	--	All to Iraq.
Metal:				
Scrap	3,348	4,132	--	West Germany 3,580; Italy 460.
Pig iron, cast iron, related materials	60,169	525	--	Iraq 500.
Ferroalloys	56,472	53,403	41,740	Netherlands 9,065.
Steel, primary forms	324,515	629,100	124	Iran 557,916; Jordan 57,408.
Semimanufactures:				
Bars, rods, angles, shapes, sections	1,078,357	1,390,981	8	Iraq 758,371; Iran 608,750.
Universals, plates, sheets	88,532	411,272	19,874	Iran 243,088; Iraq 113,504.
Hoop and strip	5,419	33,961	60	Iran 28,933; Iraq 3,210.
Rails and accessories	24	45	--	Cyprus 21; Iran 18.
Wire	10,966	11,641	--	Iran 6,401; Iraq 4,716.
Tubes, pipes, fittings	205,472	282,810	36,289	Iran 177,040; Iraq 53,033.
Casting and forgings, rough	8,693	165	--	Libya 74; Cyprus 25.
Lead:				
Ore and concentrate	76	--		
Metal including alloys:				
Scrap	1	--		
Unwrought	5	12	--	All to West Germany.
Semimanufactures	22	6	--	Cyprus 4; Libya 2.
Manganese: Ore and concentrate, metallurgical-grade	--	6,914	--	Italy 6,550; Greece 364.
Mercury 76-pound flasks	7,861	8,644	3,481	Netherlands 4,641.
Molybdenum: Metal including alloys, all forms value, thousands	$5	--		
Nickel:				
Matte and speiss do	$112	$1	--	All to Syria.
Metal including alloys, semimanufactures	38	--		
Tin: Metal including alloys, semimanufactures	--	2	--	Jordan 1; Libya 1.
Titanium: Oxides	82	3	--	Iraq 2; Italy 1.
Tungsten: Ore and concentrate	452	521	--	Austria 480; Singapore 40.
Uranium and/or thorium: Ore and concentrate value, thousands	--	$149	--	All to West Germany.
Zinc:				
Ore and concentrate	--	5,554	--	Bulgaria 2,900; Italy 1,654.
Oxides	100	693	--	France 454; Iraq 219.
Metal including alloys:				
Scrap	--	29	--	All to Cyprus.
Unwrought	112	1,664	--	Iran 1,542.
Semimanufactures	10	--		
Other:				
Ores and concentrates	2,246	3,990	--	Netherlands 2,050; Belgium-Luxembourg 1,450.
Ashes and residues	429	8,011	--	Iraq 6,000; West Germany 921.
Base metals including alloys, all forms	336	498	--	Netherlands 255; Iraq 102.

See footnote at end of table.

Table 2.—Turkey: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1984	1985	Destinations, 1985	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	13,656	7,619	--	Netherlands 5,777; France 1,470.
Grinding and polishing wheels and stones	47	196	--	Iran 151; Iraq 13; Saudi Arabia 13.
Asbestos, crude	100	9	--	All to Iraq.
Barite and witherite	215,981	191,934	18,952	U.S.S.R. 70,946; Egypt 50,899; West Germany 18,844.
Boron materials:				
Crude natural borates	802,555	719,088	140,653	Italy 122,860; France 87,380; United Kingdom 61,976.
Oxides and acids	27,060	21,380	5,410	Belgium-Luxembourg 8,550; Italy 2,200.
Cement thousand tons	1,998	1,827	--	Egypt 1,354; Malta 91.
Chalk	4,470	7,701	--	Libya 3,900; Iraq 2,301; Lebanon 1,241.
Clays, crude	89,528	78,203	--	Romania 28,985; Lebanon 18,050; West Germany 16,000.
Diatomite and other infusorial earth	364	62	--	All to Iraq.
Feldspar, fluorspar, related materials	1,034	3,061	--	Lebanon 2,500; Jordan 364; Syria 95.
Fertilizer materials, manufactured:				
Ammonia	77	28	--	Mainly to Iraq.
Nitrogenous	23,311	5,139	--	Mainly to Cyprus.
Phosphatic	160,185	261,570	--	U.S.S.R. 149,725; Bangladesh 47,200; Syria 28,400.
Potassic	201	830	--	All to Cyprus.
Unpecified and mixed	42,000	170,662	--	Iran 121,910; Cyprus 18,852.
Gypsum and plaster	854	3,657	--	United Arab Emirates 3,118; Egypt 260.
Lime	7,360	3,925	--	Cyprus 3,850.
Magnesite, crude	164,614	159,409	2,470	Austria 40,399; Greece 32,993; U.S.S.R. 19,250.
Meerschaum, amber, jet	6	--		
Mica:				
Crude including splittings and waste	162	32	--	United Kingdom 20; Iraq 12.
Worked including agglomerated splittings	(2)	2	--	Mainly to Cyprus.
Pigments, mineral: Iron oxides and hydroxides, processed	60	1,520	--	Iran 1,507.
Salt and brine	29,343	16,343	--	Iraq 13,668; Cyprus 2,486.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	55,646	112,530	--	Iran 28,000; India 14,300; Panama 12,954.
Sulfate, manufactured	468	4,539	--	Iraq 3,579; Iran 950.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	31,165	42,484	1,583	Italy 15,844; Libya 5,456; Syria 5,260.
Worked	24,798	20,831	6,874	Saudi Arabia 4,890; Lebanon 1,710.
Dolomite, chiefly refractory-grade	233	214	--	Iraq 162; Cyprus 40.
Gravel and crushed rock	10,128	4,698	--	Tunisia 3,150; Libya 746.
Limestone other than dimension	--	237	--	United Kingdom 154; Iraq 83.
Quartz and quartzite	148	63	--	Syria 36; Iran 25.
Sand other than metal-bearing	38	4,640	--	United Arab Emirates 4,600.
Sulfur:				
Elemental:				
Crude including native and by-product	200	1	--	All to Cyprus.
Colloidal, precipitated, sublimed	21	--		
Dioxide	56	--		
Sulfuric acid	65	416	--	Jordan 350; Cyprus 66.
Talc, steatite, soapstone, pyrophyllite	1,202	1,739	--	Libya 800; Iraq 695.
Other:				
Crude	64,692	94,751	--	West Germany 60,865; Belgium-Luxembourg 9,550.
Slag and dross, not metal-bearing	8,381	9,158	--	All to Cyprus.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,354	50	--	All to Libya.

See footnotes at end of table.

Table 2.—Turkey: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1984	1985	Destinations, 1985	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Carbon black	880	887	--	Iraq 877.
Coal:				
Anthracite and bituminous	--	2,000	--	All to Iraq.
Lignite including briquets	1,365	--		
Coke and semicoke	--	141	--	Cyprus 140.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	4,631	--		
Refinery products:				
Gasoline, motor do	3,698	6,905	755	Italy 4,270; Greece 952.
Mineral jelly and wax do	--	19	10	Finland 9.
Kerosene and jet fuel do	1,550	2,780	175	Italy 842; Iran 724.
Distillate fuel oil do	267	252	--	All to Cyprus.
Lubricants do	161	6	--	Cyprus 3; Iran 2.
Residual fuel oil do	2,723	2,875	--	Italy 2,467; Greece 401.
Bitumen and other residues do	11	440	--	Lebanon 268; Algeria 137.
Bituminous mixtures do	3	1	--	Mainly to Cyprus.

[1]Table prepared by Virginia A. Woodson.
[2]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals	6	21	--	West Germany 17; United Kingdom 4.
Aluminum:				
Ore and concentrate	7,675	19,408	248	China 8,503; Italy 6,513.
Oxides and hydroxides	211	628	15	United Kingdom 352; West Germany 233.
Metal including alloys:				
Scrap	30	399	--	West Germany 350; Netherlands 49.
Unwrought	68,493	59,154	457	Canada 34,521; Spain 10,590; Republic of South Africa 4,999.
Semimanufactures	1,417	3,020	43	West Germany 1,424; Netherlands 537; Italy 384.
Antimony: Ore and concentrate	7,675	19,408	248	China 8,503; Italy 6,513; West Germany 2,550.
Arsenic:				
Oxides and acids	163	418	31	West Germany 260; France 39; Belgium-Luxembourg 36.
Metal including alloys, all forms	--	58	--	Netherlands 48; Sweden 8.
Chromium:				
Ore and concentrate	--	10,878	--	Republic of South Africa 10,488.
Oxides and hydroxides	409	289	--	Italy 186; United Kingdom 71.
Cobalt: Oxides and hydroxides	37	35	--	Belgium-Luxembourg 32.
Columbium and tantalum: Metal including alloys, all forms, tantalum value thousands	$1	$15	$11	Austria $4.
Copper:				
Ore and concentrate	23,292	33,168	--	Canada 12,101; Chile 10,580; Sweden 10,487.
Matte and speiss including cement copper	817	1,221	--	Chile 1,201.
Metal including alloys:				
Scrap	60	619	--	Canada 588; Cyprus 31.
Unwrought	24,460	35,451	1,728	Chile 20,338; Spain 4,202.
Semimanufactures	10,297	12,392	623	West Germany 5,150; Italy 1,602.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS —Continued				
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite thousand tons	1,656	1,725	--	Brazil 734; Republic of South Africa 648; Liberia 184.
Metal:				
Scrap do	1,038	1,148	894	Canada 80; United Kingdom 68.
Pig iron, cast iron, related materials do	43	190	--	Brazil 93; United Kingdom 62.
Ferroalloys:				
Ferromanganese do	26	26	--	Republic of South Africa 21; France 2.
Unspecified do	27	33	(2)	Yugoslavia 13; Norway 5; Brazil 3.
Steel, primary forms do	1,483	1,971	7	Spain 429; Italy 222; Republic of South Africa 211.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	297	386	3	Spain 132; West Germany 61; Bulgaria 37.
Universals, plates, sheets do	370	595	2	Belgium-Luxembourg 95; France 67; Bulgaria 66.
Hoop and strip do	4	8	(2)	West Germany 6.
Rails and accessories do	54	22	(2)	Republic of South Africa 19.
Wire do	6	3	--	Spain 2.
Tubes, pipes, fittings do	64	84	3	Yugoslavia 23; West Gemany 10; Japan 9.
Castings and forgings, rough do	2	(2)	--	Mainly from France.
Lead:				
Oxides	201	954	--	Netherlands 464; West Germany 252; France 238.
Metal including alloys:				
Scrap	--	19	--	Cyprus 14; West Germany 5.
Unwrought	10,179	16,479	98	Morocco 5,902; Spain 5,227; Belgium-Luxembourg 2,385.
Semimanufactures	160	2	(2)	Mainly from West Germany.
Magnesium: Metal including alloys:				
Unwrought	62	80	13	France 22; Canada 18.
Semimanufactures	(3)	7	--	Italy 6.
Manganese:				
Ore and concentrate, metallurgical-grade	1,348	1,300	--	Belgium-Luxembourg 1,000; Gabon 300.
Oxides	602	356	(2)	West Germany 180; Republic of South Africa 100.
Molybdenum: Metal including alloys, all forms	2	2	1	United Kingdom 1.
Nickel:				
Matte and speiss	817	15	--	West Germany 14.
Metal including alloys:				
Unwrought	2	680	40	United Kingdom 79; Netherlands 74.
Semimanufactures	197	285	1	West Germany 225; Austria 34.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$331	$252	$2	West Germany $103; Republic of South Africa $73; Switzerland $41.
Selenium, elemental kilograms	--	2	--	All from West Germany.
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$502	$709	--	West Germany $565; Sweden $91; Belgium-Luxembourg $43.
Tellurium, elemental kilograms	--	18	--	United Kingdom 17.
Tin:				
Oxides	21	--		
Metal including alloys:				
Scrap value, thousands	--	$3	$1	Belgium-Luxembourg $2.
Unwrought	853	1,006	(4)	Malaysia 550; Brazil 147; Thailand 95.
Semimanufactures	10	11	(4)	West Germany 4; Japan 4.
Titanium: Oxides	2,387	2,782	44	West Germany 1,476; United Kingdom 363; France 201.
Tungsten: Metal including alloys, all forms	6	27	1	Hong Kong 15; Netherlands 3.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS —Continued				
Zinc:				
Ore and concentrate	--	9,633	--	Iran 7,818; Spain 1,815.
Oxides	894	626	1	West Germany 614.
Blue powder	23	--		
Metal including alloys:				
Unwrought	18,374	27,573	(4)	Italy 11,871; Belgium-Luxembourg 8,597; France 1,689.
Semimanufactures	9	65	--	Belgium-Luxembourg 40; West Germany 25.
Other:				
Ores and concentrates	4,073	3,628	--	Australia 2,622 Italy 238.
Oxides and hydroxides	442	418	31	West Germany 260; France 39; Belgium-Luxembourg 36.
Ashes and residues	60	10	--	All from Cyprus.
Base metals including alloys, all forms	71	143	(5)	Netherlands 60; United Kingdom 49.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	2	31	31	
Artificial:				
Corundum	1,848	1,576	(2)	West Germany 881; Poland 180; Italy 98.
Silicon carbide	--	655	(2)	West Germany 561; France 33.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$510	$907	$242	Ireland $310; West Germany $130.
Grinding and polishing wheels and stones	196	278	3	Italy 77; Norway 74; West Germany 39.
Asbestos, crude	21,872	25,545	--	Canada 8,534; Greece 7,213; Republic of South Africa 5,064.
Barite and witherite	2	2	2	
Boron materials: Oxides and acids	(4)	81	--	Mainly from West Germany.
Bromine kilograms	(2)	187	--	West Germany 185.
Cement	5,932	4,456	706	West Germany 1,600; France 1,080; Netherlands 644.
Chalk	7	77	50	Japan 10; Spain 5.
Clays, crude	7,045	8,102	21	United Kingdom 7,701; West Germany 309.
Cryolite and chiolite	41	21	--	All from Denmark.
Diamond:				
Gem, not set or strung value, thousands	--	$604	$93	Belgium-Luxembourg $488.
Industrial stones do	$446	$213	--	Netherlands $75; Zaire $46; Belgium-Luxembourg $41.
Diatomite and other infusorial earth	142	81	65	Italy 11.
Feldspar, fluorspar, related materials:				
Feldspar	25	20	--	All from West Germany.
Fluorspar	r21	636	--	Mexico 525; Italy 93.
Fertilizer materials:				
Crude, n.e.s	55	23,803	--	Israel 16,112; Jordan 7,501.
Manufactured:				
Ammonia	548,733	579,058	28,853	U.S.S.R. 384,732; Trinidad and Tobago 50,518.
Nitrogenous	923,220	1,148,366	106,243	Italy 288,414; Romania 242,368; U.S.S.R. 89,029.
Potassic	60,526	23,205	--	Belgium-Luxembourg 11,946; Israel 8,714.
Unspecified and mixed	134,445	245,653	230,190	Republic of South Africa 15,000.
Graphite, natural	474	554	--	West Germany 536; China 15.
Gypsum and plaster	3	--		
Lime	--	7	--	All from Netherlands.
Magnesium compounds:				
Magnesite, crude	45	94	6	West Germany 73; Italy 5.
Oxides and hydroxides	46	61	--	Italy 46; West Germany 8.
Mica:				
Crude including splittings and waste	25	20	--	Republic of South Africa 15; West Germany 5.
Worked including agglomerated splittings	46	55	(2)	Spain 22; Belgium-Luxembourg 13; India 8.
Phosphates, crude	727,758	712,049	--	Israel 250,416; Jordan 220,777; Tunisia 36,653.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Pigments, mineral:				
Natural, crude	23	--		
Iron oxides and hydroxides, processed	536	1,517	11	Italy 870; West Germany 549.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$8	$186	--	West Germany $86; Thailand $76; Belgium-Luxembourg $18.
Synthetic do.	$66	$87	--	Switzerland $53; France $21.
Pyrite, unroasted	166,070	98,324	--	Spain 76,337; Norway 14,271.
Salt and brine	94	122	--	Mainly from West Germany.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	16,953	2,248	--	Bulgaria 2,197; Italy 50.
Sulfate, manufactured	119,600	151,163	21,824	Italy 69,184; France 33,909.
Stone, sand and gravel:				
Dimension stone, worked	2	2	--	France 1; West Germany 1.
Dolomite, chiefly refractory-grade	--	1	--	All from Italy.
Gravel and crushed rock	--	2	--	West Germany 1; United Kingdom 1.
Quartz and quartzite	374	292	--	West Germany 226; Italy 41.
Sand other than metal-bearing	10,058	4,021	(2)	Belgium-Luxembourg 4,017.
Sulfur:				
Elemental:				
Crude including native and by-product	20,998	111,006	23,518	Saudi Arabia 40,655; United Arab Emirates 22,455.
Colloidal, precipitated, sublimed	4,844	95	--	Mainly from West Germany.
Dioxide	10	4	--	Belgium-Luxembourg 2; West Germany 1.
Sulfuric acid	179,341	119,131	(2)	Japan 58,357; Italy 23,066; Spain 19,850.
Talc, steatite, soapstone, pyrophyllite	585	420	--	West Germany 238; Italy 130.
Other: Crude	2,996	2,842	--	West Germany 1,619; United Kingdom 729; Italy 481.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	59	72	72	
Carbon black	12,669	15,742	16	Italy 10,001; West Germany 3,381.
Coal:				
Anthracite and bituminous thousand tons	1,928	2,139	1,391	Australia 438; Republic of South Africa 267.
Briquets of anthracite and bituminous coal	5,049	--		
Lignite including briquets	60,795	173,939	107,877	Republic of South Africa 55,807.
Coke and semicoke	172,112	181,087	101,351	Japan 38,917; Egypt 16,222.
Peat including briquets and litter	--	74	--	Mainly from Netherlands.
Petroleum:				
Crude thousand 42-gallon barrels	111,355	111,636	--	Iran 41,364; Iraq 37,486; Libya 18,705.
Refinery products:				
Liquefied petroleum gas do.	4,910	5,265	--	Kuwait 3,999; Iraq 1,266.
Gasoline, motor do.	41	102	61	Austria 27; West Germany 9.
Mineral jelly and wax do.	12	15	(4)	West Germany 7; Netherlands 3.
Kerosene and jet fuel do.	3	21	--	Belgium-Luxembourg 13; Austria 3; U.S.S.R. 3.
Distillate fuel oil do.	2,183	3,606	--	U.S.S.R. 1,646; Iraq 746; Bulgaria 649.
Lubricants do.	129	142	40	Belgium-Luxembourg 30; Netherlands 14; Romania 14.
Residual fuel oil do.	1,902	1,160	--	Iran 1,082.
Bitumen and other residues do.	(2)	(2)	--	All from East Germany.
Bituminous mixtures do.	2	1	(2)	Mainly form United Kingdom.
Petroleum coke do.	1,731	2,278	152	Syria 2,124.

r Revised.
[1] Table prepared by Virginia A. Woodson.
[2] Less than 1/2 unit.
[3] Unreported quantity valued at $10,000.
[4] Unreported quantity valued at $1,000.
[5] Unreported quantity valued at $23,000.

COMMODITY REVIEW

METALS

Aluminum.—Turkey's only aluminum production, approximately 50,000 tons per year, was adversely affected by a lengthy strike in 1987. The sole plant complex, located at Konya in south central Turkey, produced approximately one-half of the country's aluminum requirements. Expansion plans for the Seydisehir plant were halted in 1987 owing to the high cost of energy there. Instead, Etibank was considering a project for a 250,000-ton-per-year aluminum plant at Milas, near Turkey's southwestern coastline, utilizing local bauxite reserves.

Antimony.—Mining for antimony began in Turkey at the beginning of the 20th century. In 1987 there were 128 known deposits in the country, with the more important ones located in the following areas: Turhal, Tokat, of the Dagardi area; Muratdagi, Kutahya, Ivrindi, Balikesir, and Odemis of the Izmir area; several locations in the Ankara area; and nearby Sogut, Bilecik. Reserves were estimated at 6.3 million tons, grading 1.65% antimony.

Chromite.—In 1987, there were 710 known chromite deposits in Turkey. They were in six main areas: the Guleman-Elazig area in the east, the Fethiye-Koycegiz-Denizli area in the southwest, the Bursa-Eskisehir area in the northwest, the Kayseri-Adana-Mersin area in the south, the Kopdag area in the east, and the Iskenderun-Islahiye-Maras area in the south. Apart from these major areas, small scattered deposits at various locations were known. Reserves at yearend were estimated at 31 million tons of chromite grading 30% to 48% Cr_2O_3.

Etibank's 1987 chromite ore production was approximately 500,000 tons, which made the agency once again the dominant force in Turkish chromium production. Etibank's concentrates totaled approximately 250,000 tons in 1987, which was 55,000 tons more than in 1986. Exports of Etibank concentrates were actually expected to decrease as Turkey's young domestic ferrochrome industry at Elazig was to be expanded in 1988.

Etibank was Turkey's only ferrochrome producer, with two plants in operation in two locations. The Elazig plant in southeast Turkey produced approximately 43,000 tons of ferrochrome. The plant's capacity was being increased from 50,000 to 150,000 tons per year. The expansion project was expected to be completed by the end of 1989, with one new furnace operational by mid-1988. Etibank was building a facility about 20 kilometers from Elazig to produce 100,000 tons per year of feedstock for the Elazig high-carbon ferrochrome plant. This preparation plant was expected to be completed in 1989.

Etibank's other ferrochrome plant, at Antalya, was a low-carbon ferrochromium smelter built in the 1960's, had a production capacity of 10,000 tons and produced approximately 8,000 tons in 1987.

Copper.—Despite substantial reserves, Turkey continued to rely on imports for 70% of the country's copper needs. A new concentrator was commissioned last year at the Kure copper mine and smelter, situated roughly in the middle of Turkey's Black Sea coastline. Etibank was expecting the new concentrator to produce 45,000 tons of copper concentrate and 225,000 tons of pyrite concentrate in 1988. Etibank expected the plant to reach full capacity output of 90,000 tons of copper concentrate and 225,000 tons of pyrite concentrate in 1989.

Iron Ore.—The Divrigi Iron Mines Co. marked record-high production and shipments from its operations at Divrigi, in the Anatolia region of central Turkey. The open pit operation produced over 2.3 million tons of ore, with subsequent production of 1.56 million tons of pellets, sinter feed, and lump ore from beneficiation and pelletizing facilities nearby. Approximately 80% of the mine output was magnetite, while the rest was hematite.

Owned by the Turkish Iron & Steel Works, the new pellet plant produced 864,000 tons of product and shipped 746,000 tons to three steel plants in Turkey, with 60% of the total going to the Iskenderum steel mill. Iskenderum also received most of the 510,000 tons of sinter feed shipped from Divrigi.

Iron and Steel.—Pig iron output rose approximately 6.3% over that of 1986. Steel output was more than 7 million tons; an 18.8% increase over 1986. Both the private and public sectors were involved in expanding plant capacities, with the public sector responsible for approximately 56% of Turkey's steel production. Three of Tur-

key's four state-owned steel plants increased production in 1987.

Silver.—In the last half of 1987 Etibank commissioned a silver mine at Gumuskoy, 200 kilometers west of Ankara. Turkey's only silver mine, the operation produced approximately 2 tons of silver ingots by yearend. Operated by Etibank, the mine was expected to produce 30 tons of ingots in 1988. Hazen Research of the United States was a consultant to Etibank on the project, and the Krupp Group of the Federal Republic of Germany handled the mine's startup operations.

INDUSTRIAL MINERALS

Asbestos.—Asbestos was discovered in Turkey in 1921. At yearend there were 119 known deposit locations. The more important chrysotile deposits were at Tobuk near Bursa, Agri and Kizildag in the Hatay area, the Yagcilar deposit at Izmir, Armutalan near Mugla, the Destumi deposit in the Siirt area, and Celalli near Sivas. The Celalli deposits were considered the most important commercially. Chrysotile reserves were estimated at 16.6 million tons, and amphibole reserves were estimated at 1.1 million tons.

Boron.—In terms of industrial mineral production, Etibank continued to be the country's sole boron minerals and derivatives producer and the second largest producer of boron in the world after the United States. Proven reserves of borax were reported at 519 million tons. In 1986, concentrate production was more than 1.1 million tons, while production of boron products was reported to be 98,400 tons.

The boron mineral reserve distribution in Turkey was reported by Etibank in September 1987 and is summarized below:

Area of reserves	Quantity (thousand tons)	Boron oxide (thousand tons)	Boron oxide (percent)
Balikesir-Bigadic	724	217	30-34
Bursa-Kestelek	9	3	30-35
Eskisehir-Kirka	573	143	25-36
Kutahya-Emet	683	205	30-40
Total	1,989	568	

Deposits found north of the town of Bigadic in Balikesir Province produce colemanite and ulexite, whereas deposits in Kutahya Province produce mainly colemanite. The only commercial sodium borate deposit in Turkey was at the Kirka Mine, between Afyon and Eskisehir Provinces.

At the beginning of 1987, Etibank's boron operations had the following annual salable production capacities and work force:

Mine	Capacity (thousand tons)	Employees
Bigadic Mining Co	200	1,950
Emet Colemanite Co	500	1,950
Kestelek Mining Co	100	550
Kirka Boraks Co	500	900
Total	1,300	5,350

Production capacities of compounds at Eskisehir were as follows: pentahydrate borax, 176,000 tons; anhydrous borax, 66,000 tons, and decahydrate borax, 19,000 tons. Capacities at the Bandirma borax and boric acid plant were reported as follows: decahydrate borax, 61,000 tons; boric acid, 36,000 tons; and sodium perborate, 20,000 tons.

Etibank's new boron derivatives plant at Kirka increased production of its output, boron pentahydrate concentrate, by approximately 70% over that of 1986, to a total of 50,000 tons. Targeted production for 1988 is 90,000 tons. Full plant capacity was rated at 140,000 tons. Owing to the increased Kirka output, as well as other expansion projects, Etibank produced 430,000 tons of tincal in 1987.

The boric acid facility at Bandirma was expanded and commissioned in the latter half of 1987. The new line produced 5,000 tons in 1987, and was expected to produce 10,000 tons in 1988. The old acid line at Bandirma produced 15,000 tons in 1987.

Cement.—Cement production made another sizable jump upward in 1987, to just under 22 million tons, which represented a 10% increase over that of 1986. The rapid growth in building construction in Turkey, however, was even more pronounced and imports of cement increased dramatically.

Several projects involving new plants and the modernization of existing plants were either completed during 1987 or near completion. Citosan Group's 600,000-ton-per-year plant at Denizli started up full-scale operations at yearend. Dyckerhoff Engineering GmbH of the Federal Republic of Germany handled the engineering on this project. The Citosan Group also announced at yearend that Loesche GmbH of the Federal Republic of Germany would be supplying six of its cement plants with coal milling

equipment. Each line was to consist of equipment for handling raw coal, a dry grinding plant, storage and conveyance systems, and a kiln firing system. These lines were expected to be operational by yearend 1988.

Bursa Cimento Fabrikasi AS completed and brought on-line an air separator and cement mill by yearend. Equipment was supplied by F. L. Smidth (FLS), of Copenhagen, Denmark. Canakkale Cement Industry Co. of Istanbul continued with a project to double the capacity of its plant from 2,500 to 5,000 tons per day, by adding a second preheater tower, a precalciner for each preheater tower, and an electrostatic precipitator. The plant coolers were being lengthened, and a new finishing mill and new packhouse were being built. Startup of the new systems was expected by mid-1988.

Nuh Cimento Sanayii AS was finishing work on a new cement grinding plant, which it hoped to put on-line by spring 1988. The plant was to have a mill, roller press, and air separator. The equipment was being supplied by FLS. Bati Anadolu Cimento Sanayii AS continued upgrading the production of the number 2 kiln line at its Izmir plant. The line's capacity was to increase from 1,300 to 1,700 tons per day. The construction, which included installation of a roller press, was being handled by KHD Humboldt Wedag AG of the Federal Republic of Germany.

Cimsa Cimento Sanayi ve Ticaret AS was converting two of its cement mills from open to closed grinding with high-efficiency separators. In addition, the company was installing a roller press. Equipment was being supplied by FLS and the startup date for the new systems was spring 1988. Yibitas Cimento Fabrikasi AS was also converting two mills from open to closed circuit grinding with high-efficiency FLS separators.

Eskisehir Cimento Fabrikasi T.A.S. was expanding its kiln preheater system from a capacity of 700 to 1,400 tons per day. The project was being handled by Polysius Corp. of France. Polysius was also handling installation of a high-pressure grinding roller at the Izmir Cement Co. plant. A third project being handled by Polysius was the reconstruction of a cement kiln line for Bursa Cimento Sanayii. Line throughput was being increased from 750 to 1,850 tons per day. The rebuilt system was to include a roller mill, a clinker cooler, and a conveying system for feeding coal to the main burner and precalcining unit.

Fertilizer Materials.—Turkey's agricultural industry continued to rely heavily on imports of fertilizers to meet its needs in 1987. Fertilizers were the country's second biggest import item after petroleum. Although phosphate exploration began in Turkey in the early 1900's, the first phosphate deposit was not discovered until 1962, in the Mazidag area of southeastern Turkey. Almost 50 deposits were known to exist at yearend, with estimated reserves of 446 million tons, of which 70 million tons were considered commercially exploitable.

Soda Ash.—Trona was discovered in Turkey in 1979. There was only one known deposit at yearend, at Beypazari near Ankara. This deposit was considered especially important since the nearby market countries of Europe had no known natural soda deposits. Reserves were estimated at 240 million tons.

MINERAL FUELS

Coal.—The coal mining industry continued to expand dramatically during 1987, particularly in the lignite sector. Not even the rapidly growing steel industry could match the increases in the coal industry. After the energy crisis of the 1970's, the Government of Turkey developed a policy of moving towards maximum utilization of Turkey's substantial coal reserves for domestic energy requirements.

Lignite mining began in the 1940's in western Turkey, by Garp Linyitleri Ismetmesi Muesessesi. Mechanized surface mining of lignite was introduced in the 1960's by the state agency, Turkiye Komur Isletmeleri (TKI). In 1970, the first dragline began operations at Tuncbilek. Since 1982 the production of lignite has nearly doubled, with the rapid expansion of surface mining utilizing electric shovels. Towards the end of 1987, the P&H Co. of Milwaukee, Wisconsin, completed construction of 36 electric shovels for TKI. At the end of 1987, TKI had seven projects under way or nearing completion for expanding Turkey's lignite mining. All of these projects involved medium-to large-scale surface operations, using electric draglines and shovels. The largest project, at Afsin-Elbistan Linyitleri Isletmesi Muessesesi, was using bucket wheel excavators and was responsible for 40% of Turkey's lignite production.

Natural Gas.—Construction of the natural gas pipeline from the Bulgarian border to Ankara was ongoing throughout 1987 and was scheduled for completion in mid-1988.

The planned 847-kilometer-long supply line started transporting natural gas under a long-term contract with the U.S.S.R. during 1987, even though it was only partially finished. The Government of Turkey signed a 25-year agreement with the U.S.S.R. in 1984 for buying 5 to 6 billion cubic feet of natural gas per year.

Turkiye Petrolleri Anonim Ortakliki (TPAO), Turkey's only natural gas producer in 1987, reported production of approximately 10 billion cubic feet of gas, down by almost one-third from 1986. Consumption of natural gas was approximately 16 billion cubic feet.

Petroleum.—*Production.*—The steady decline in crude oil production from a peak of 25 million barrels in 1973 to approximately 15 million barrels in 1985 was reversed in 1986, and production increased in 1987 to almost 19 million barrels.

In 1987, as in 1986, Shell Oil Co. and TPAO each produced about 20,000 barrels per day. Shell's major production fields were the Beykan and Kurkan Fields, with outputs of approximately 4,000 barrels per day and 3,500 barrels per day, respectively. Shell produced crude oil from 15 different fields. TPAO produced crude from 25 fields. TPAO's oldest production field, Raman, remained its largest producer with an output of approximately 6,600 barrels per day. Other major production sites for TPAO were the Bati Raman Field, and the most recent major field developed in Turkey, the Guney Dincer Field.

Refining.—Construction of facilities for another 40 million barrels per year of refinery capacity was completed and commissioned at Izmir during 1987, increasing Turkey's total refining capacity to more than 264 million barrels per year. The country's fifth oil refinery was commissioned late in October 1986. The new refinery, at Kirrikale near Ankara, had a capacity of 40 million barrels per year, and raised the country's total refining capacity to 230 million barrels annually. Along with the new refinery, 450 kilometers of supply pipeline transporting crude oil feedstock from Adana on the coast began operation. The pipeline was designed to eventually double its carrying capacity from 40 to 80 million barrels per year, to match an expected increase in refining capacity at Kirrikale in coming years.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Turkish lira (TL) to U.S. dollars at the rate of TL900=US$1.00.

The Mineral Industry of the U.S.S.R.[1]

By Richard M. Levine[2]

In 1987, a year characterized by the introduction of a new openness of discussion "glasnost," and a reform of many of the economic mechanisms to make them more amenable to market forces "perestroika," the Soviet economy registered a 2.3% growth in national income and a 3.8% increase in industrial production, both over 1986 levels, but these increases were less than in 1986. Many of the major reforms enacted in 1987 would not actually go into effect until 1988, and may not show results, if successful, until a later period. Also, with the exception of now reporting steel, coal, natural gas and oil trade data, the policy of openness had not yet extended to the overwhelming majority of mineral commodities for which production and trade data was still secret.

Glasnost, however, allowed for a more open discussion of Soviet mineral policy. This policy traditionally was intended to continuously increase mineral production to ensure mineral self-sufficiency, although at great cost, for national security and to promote an autarkic economic policy. Soviet mineral policy was also designed to provide minerals for export for hard currency as well as for export in countertrade agreements to its Council for Mutual Economic Assistance (CMEA)[3] partners to integrate their economies with that of the U.S.S.R. In an article in the national daily newspaper Sotsialisticheskaya industriya (Socialist Industry), it was claimed that it was a stereotyped way of thinking to believe that a high level of raw material extraction strengthened defense capability and economic independence. The question was raised as to whether importing minerals would really jeopardize security any more than was currently occurring by importing food and technology. Regarding economic well-being, Japan was cited as a country that was able to prosper despite importing most of its mineral raw material requirements. A change of goals in mineral policy was advocated that would eliminate the current costly and inefficient approach to mineral development that was impeding improving the standard of living. Restructuring, in this area, it was claimed, "must begin by determining the quantity of raw materials it would be expedient to extract in our country" rather than constantly trying to expand output.[4]

Other commentators discussed the need to reduce the share of mineral exports in proportion to manufactured goods, which were not competitive on world markets and comprised less than 5% of Soviet exports to market economy countries. For example, an article in the national economic weekly newspaper Ekonomicheskaya gazeta (Economic Gazette) declared "the very rapid renewal of our export structure—an increase in the proportion of finished products and a decrease in the proportion of fuel and raw materials—is one of the most pressing trends of our economic activity."[5]

Restructuring as described above was only in the discussion stage, and would be a long way, if ever, from being implemented. However, if the Soviet Union were ever to become a cost effective mineral producer and trader, it would significantly affect world mineral-trade patterns.

In 1987, the dominant feature of the Soviet mineral industry was the success of the oil industry, which produced a record high 4.6 billion barrels of oil and gas condensate, exceeding the peak production level of 4.5 billion barrels achieved in 1983, and recovering from a 2-year decline in oil

production in 1984 and 1985 when production fell to 4.4 billion barrels. Success was achieved by the coal industry, which surpassed its 1986 record-high level of production by 2%, reversing in the last 2 years a decade-long decline in coal production. Natural gas production again recorded a large increase of 6%, securing the U.S.S.R.'s position as the world's leading natural gas producer. In ferrous and nonferrous metallurgy, the plan for the production of metallurgical products was reportedly fulfilled. In ferrous metallurgy there was an increase in the output of rolled steel, pipes, and metal products, with very little increase in iron ore, pig iron, or coke production, which was in accord with the program to increase efficiency in steelmaking. However, the plan to produce high-quality steel products was far from accomplished as targets for only 6 out of 25 types of high-quality steel products were met.

In 1987, a new system of industrial management was decreed that allowed industrial managers greater autonomy over production targets, buying supplies, selling output, and spending profits. The new system, introduced on a trial basis for a small number of enterprises, as of January 1, 1988, was to be introduced to enterprises producing 60% of the country's industrial output. However, during 1988 the majority of their output would still be sold directly to the state in accordance with planned directives. The new system was designed to give enterprises greater freedom from centralized planning and management, but it remained to be seen whether the new system, which was characterized by such phrases as "self-financing," "self-management," and "economic accountability," would actually provide the autonomy from centralized decision-making envisioned.

In an organizational change, the Central Statistical Administration (TsSU), which collected and controlled the dissemination of all economic data in the country, was reorganized and renamed the Union-Republic U.S.S.R. State Committee for Statistics (Goskomstat). This change was intended to facilitate restructuring as its goal was to provide enterprises with more relevant statistical reporting for implementing the new management systems.

A number of organizational changes occurred in the mineral sector. The Union-Republic ministries of Coal, Ferrous Metallurgy, Geology, and Nonferrous Metallurgy became All-Union ministries. This change eliminated several layers of administration because Union-Republic ministries could have parallel ministries in the 15 Republics—i.e. the Union-Republic Ministry of Ferrous Metallurgy had a subordinate Ministry of Ferrous Metallurgy in the Ukrainian S.S.R.—and All-Union ministries had only one organization titled ministry in Moscow. Along with the Ukrainian Ministry of Ferrous Metallurgy, this change abolished the Ministry of Ferrous Metallurgy in the Georgian S.S.R.; the Ministry of Nonferrous Metallurgy in the Kazakh S.S.R.; the Ministries of Geology in the Russian Republic (R.S.F.S.R.), the Kazakh S.S.R., the Ukrainian S.S.R., and the Uzbek S.S.R.; and the Ministry of the Coal Industry in the Ukrainian S.S.R.

One of the most important goals of restructuring was "to stop excessive spending on the use of natural resources in production as well as the rational utilization of these resources," thereby altering the previous extensive growth strategy that promoted growth chiefly by increasing inputs, and instead promoting an intensive growth strategy stressing a more efficient use of inputs.[6] There was great room for resource savings. For example, the U.S.S.R. consumed twice as much metal per unit of national income produced as did the United States.[7] In 1987, the target set for saving fuel and energy resources was fulfilled with savings accounting for 43% of the increased demand for these resources. However, the country was unsuccessful in meeting its targets for savings in steel consumption.

Geology and Exploration.—In 1987, in an organizational change, the Union-Republic Ministry of Geology was changed to the All-Union Ministry of Geology, thereby abolishing the republic ministries of geology that existed in the R.S.F.S.R., Kazakhstan, the Ukraine, and Uzbekistan.

Reportedly, the plan for 1987 and for the 1986-87 period for the growth and confirmation of reserves was fulfilled for all minerals. Arrears in the confirmation of copper, lead, zinc, and natural gas reserves were eliminated. Problems were occurring, however, in fulfilling targets for deep drilling for oil and gas. The exploration sector, which was adopting the reforms of perestroika to improve efficiency, was also troubled by the fact that up to 20% of worktime was lost owing to work stoppages and accidents.[8]

Problems were declared overcome in proceeding with the plan for drilling the

world's deepest hole in the Kola Peninsula, which was to reach 14,000 meters by 1990. Drilling had stopped at 12,066 meters owing to technical difficulties. During the year, the Soviets conducted five underground nuclear explosions in an experiment to stimulate hydrocarbon yields in the Ural Mountains and East Siberia. According to Soviet sources, the test wells were hermetically sealed and no radiation vented into the atmosphere. The success of these experiments had not yet been determined.

A new Soviet research vessel for studying seabed geology, the *Akademik Nikolay Strakhov,* was commissioned. The ship, which belonged to the U.S.S.R. Academy of Sciences Geological Institute, was equipped for geophysical, geochemical, lithologic, and paleontological study of the seabed. The ship's first voyage would be to the Mediterranean Sea where work would be conducted in cooperation with scientists from countries in that region.

At the beginning of the year, the Main Administration for Geodesy and Cartography was permitted to market satellite imagery on the world market with a resolution of about 6 meters. Previously, only the United States and France had been marketing satellite imagery with neither country offering the degree of resolution being offered by the Soviets.

During the year, the U.S.S.R. was giving assistance in the field of geology to 29 countries. In the areas of foreign relations, the U.S.S.R. Minister of Geology met in October in Kabul with the Chairman of Afghanistan's Revolutionary Council to discuss cooperation in geology and prospecting for minerals, and a protocol on cooperation was signed. The U.S.S.R. also conducted talks with representatives from Yemen (Aden) concerning economic and scientific cooperation in the field of oil and other minerals, and in 1987, a geological survey of the western part of Yemen (Aden) was carried out.

Safety.—The U.S.S.R. started reporting mining accidents more openly. However, only certain accidents were reported, and the country was still not reporting absolute statistics on mine safety. It was reported that in the coal mining sector, industrial injuries decreased by 7.5% in 1986 in comparison with 1985 and by 2.6% in the first half of 1987 in comparison with the first half of 1986. In several coal mining accidents that resulted in fatalities, breaches of safety regulations were cited.[9] Furthermore, complaints were raised that miners lacked basic safety equipment and needed 800,000 to 900,000 self-rescuers.

Technology.—Open pit mining accounted for a large percentage of the ore mined. More than 42% of coal, 86% of iron ore, 96% of mined material in nonferrous production, almost 100% of industrial minerals, and more than 75% of chemical raw materials for agriculture were obtained from open pit mines. More than 95% of nonferrous and rare metals ores was beneficiated. The majority of nonferrous ores was beneficiated by flotation processes. The U.S.S.R., however, produced only about 80 to 90 types of flotation reagents in comparison with 300 types in market economy countries. Extraction of metal from ore reportedly averaged 1.5% to 2% less metal than in market economy countries while the amount of reagents used was two to three times greater for processing the same volume of ore.[10]

A major task for the 1986-90 period was to increase production of metallic powders. The U.S.S.R. was producing more than 150 types of metallic powders, including powders from aluminum, cobalt, copper, iridium, lead, magnesium, nickel, osmium, palladium, platinum, silver, tin, titanium, and zinc. However, production of many of these powders was still in the experimental stage.[11]

The U.S.S.R. was addressing the problem of the use of outmoded equipment in nonferrous metallurgy as part of its effort to solicit solutions to improve economic efficiency. The allotted period for amortizing machinery and equipment was 16 to 17 years, but the actual period of use was 30% to 50% greater.[12] Along with outmoded equipment, there was also the problem of the accumulation of new equipment in warehouses that had yet to be installed. In the nonferrous metallurgy sector over one-third of the uninstalled equipment consisted of imports.[13]

PRODUCTION

Statistics on output, enterprise capacity, and production plans in physical units of output for nonferrous, precious and rare metals, and some industrial minerals were classified as state secrets. Soviet trade data on precious metals had not been available for decades, and in 1976, the Soviets stopped publishing trade statistics for nonferrous metals. Production and trade data were available for some ferrous metals and some industrial minerals. Also, for the first time in more than a decade the Soviets began reporting trade data for steel, coal, natural gas, and oil.

Table 1.—U.S.S.R.: Estimated[1] production of mineral commodities[2]

(Thousand metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS					
Aluminum:					
Ore and concentrate:					
Bauxite, 26% to 57% alumina	4,600	4,600	4,600	4,600	4,600
Nepheline concentrate, 25% to 30% alumina	r1,600	r1,600	3 1,615	3 1,638	3 1,660
Alunite ore, 16% to 18% alumina	615	615	615	620	625
Alumina	3,200	3,300	3,500	3,500	3,500
Metal, smelter:					
Primary	2,000	2,100	2,200	2,300	2,400
Secondary	r400	r450	r500	r550	600
Total	r2,400	r2,550	r2,700	r2,850	3,000
Antimony, mine output, recoverable Sb content tons	9,200	9,300	9,400	9,500	9,600
Arsenic, white (As_2O_3) do	7,900	8,000	8,100	8,100	8,100
Beryllium: Beryl, cobbed, 10% to 20% BeO do	1,900	1,900	1,900	2,000	2,000
Bismuth, mine output, recoverable Bi content do	80	82	83	84	85
Cadmium metal, smelter do	r3,000	3,000	3,000	3,000	3,000
Chromium:					
Chrome ore, crude	3,350	r3,500	r3,700	3 4,030	3 4,000
Chrome ore, marketable	r3,200	r3,300	3 3,360	3 3,640	3 3,570
Cobalt:					
Mine output, recoverable Co content tons	2,400	2,600	2,700	2,800	2,800
Plant production, Co content do	4,400	4,700	4,800	5,300	5,300
Copper:					
Ore:					
Gross weight, 0.5% to 2% Cu	84,000	85,000	86,000	89,000	91,000
Cu content, recoverable	570	590	600	620	630
Metal:					
Blister:					
Primary	700	735	750	770	780
Secondary	139	141	143	145	147
Refined:					
Primary	776	790	810	r830	840
Secondary	139	141	143	145	147
Gold, mine output, Au content thousand troy ounces	8,600	8,650	8,700	8,850	8,900
Iron and steel:					
Iron ore, 55% to 63% Fe[3]	245,200	247,104	247,639	249,959	250,874
Iron ore, Fe content[3]	133,563	134,809	136,000	137,000	138,000
Agglomerated products:[4]					
Sinter	151,000	151,000	3 148,000	154,466	154,000
Pellets	59,800	63,100	3 65,000	66,476	67,500
Metal:					
Pig iron and blast furnace ferroalloys:					
Pig iron for steelmaking[3]	102,958	103,469	102,840	105,881	106,026
Foundry pig iron[4]	6,700	6,800	6,500	3 7,200	3 7,200
Spiegeleisen[5]	50	50	3 19	3 20	3 19
Ferromanganese[5]	650	550	3 574	3 601	3 593
Total[3 6]	110,453	r110,893	r109,977	113,840	113,877

See footnotes at end of table.

Table 1.—U.S.S.R.: Estimated[1] production of mineral commodities[2] —Continued

(Thousand metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS —Continued					
Iron and steel —Continued					
Metal —Continued					
Electric-furnace ferroalloys	2,100	2,300	2,300	2,400	2,500
Steel, crude[3]	152,514	154,238	154,668	160,550	161,887
Rolled steel[3]	106,443	107,299	108,274	111,996	114,081
Semimanufactures:					
Wire rods[3]	8,300	8,400	8,836	8,715	8,800
Pipe stock[3]	6,400	6,400	5,586	6,565	6,878
Tubes from ingots[3]	1,862	1,931	1,930	1,963	1,929
Selected end products:					
Total pipes and tubes[3]	18,732	18,883	19,354	19,817	20,346
Cold-rolled sheet[3]	8,774	9,396	9,602	9,915	10,160
Lead:					
Mine output, recoverable Pb content	435	440	440	440	440
Metal, smelter:					
Primary	490	495	500	500	505
Secondary	255	260	265	270	275
Magnesium metal, including secondary	83	85	87	89	90
Manganese concentrate:[3]					
Gross weight	9,876	10,089	9,900	9,300	9,400
Mn content	2,976	2,994	2,900	2,800	2,800
Mercury metal, including secondary 76-pound flasks	64,000	64,000	65,000	66,000	67,000
Molybdenum, mine output, Mo content tons	11,100	11,200	11,300	11,400	11,500
Nickel:					
Mine output, Ni content	170	175	180	185	185
Plant production, Ni content	186	r190	r196	201	201
Platinum-group metals, mine output, Pt content thousand troy ounces	3,600	3,700	3,800	3,850	3,900
Silver metal including secondary do	47,200	47,400	47,900	48,200	48,200
Tin:					
Mine output, recoverable Sn content tons	r12,000	r12,000	r13,500	r14,500	16,000
Metal, smelter:					
Primary do	r14,500	r14,000	r16,000	r16,000	17,000
Secondary do	r3,500	r3,600	r3,700	r3,800	4,000
Total do	r18,000	r17,600	r19,700	19,800	21,000
Titanium:					
Concentrates:					
Ilmenite do	435,000	440,000	445,000	450,000	455,000
Rutile do	10,000	10,000	10,000	10,000	10,000
Metal do	41,000	41,500	43,000	43,500	46,000
Tungsten concentrate, W content do	9,100	9,100	9,200	9,200	9,200
Vanadium do	9,500	9,500	9,500	9,600	9,600
Zinc:					
Mine output, recoverable Zn content	805	810	810	810	810
Metal:					
Primary	875	900	900	900	905
Secondary	95	95	100	105	110
Zirconium metal	80	80	85	85	90
INDUSTRIAL MINERALS					
Asbestos	r2,500	2,500	r2,500	2,400	32,555
Barite	520	530	540	540	540
Boron minerals and compounds:					
Gross weight	200	200	200	200	200
B_2O_3 content	40	40	40	40	40
Bromine	68	70	70	65	65
Cement, hydraulic[3]	128,156	129,866	130,722	135,119	137,404
Clays: Kaolin including china clay	2,600	2,800	2,900	3,000	3,000
Corundum, natural tons	8,700	8,700	8,700	8,700	8,700
Diamond:					
Gem[7] thousand carats	3,700	4,300	4,400	r4,400	4,400
Industrial do	7,000	6,400	6,400	r6,400	6,400
Total do	10,700	10,700	10,800	r10,800	10,800
Diatomite	235	240	245	250	255
Feldspar	330	330	340	340	340
Fluorspar	540	550	560	560	560
Graphite	80	80	82	83	84
Gypsum	r4,200	r4,200	34,223	34,599	34,781
Iodine tons	2,000	2,000	2,000	2,000	2,000
Lime: Quicklime and hydrated including dead-burned dolomite[3]	29,500	29,500	29,200	30,122	30,121
Lithium minerals, not further specified	r55	r55	r55	r55	55

See footnotes at end of table.

Table 1.—U.S.S.R.: Estimated[1] production of mineral commodities[2] —Continued

(Thousand metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
INDUSTRIAL MINERALS —Continued					
Magnesite:					
Crude	r4,400	r4,400	r4,400	r4,300	4,300
Marketable product	r2,000	r1,975	r1,950	r1,900	1,875
Mica	49	49	50	50	50
Nitrogen: N content of ammonia	15,500	15,800	16,700	17,200	17,800
Perlite	600	600	600	600	600
Phosphate rock:					
Crude ore:					
Apatite, 15% P_2O_5	r50,000	r55,000	r62,000	r62,000	65,000
Sedimentary rock	26,200	26,400	26,400	26,400	26,600
Total	76,200	r81,400	r88,400	88,400	91,600
Concentrate:					
Apatite, 38.2% to 39.6% P_2O_5	r20,000	r20,100	e20,555	r20,700	20,800
Sedimentary rock, 19% to 30% P_2O_5	13,100	13,200	13,200	13,200	13,300
Total	r33,100	r33,300	r33,755	r33,900	34,100
Potash:					
Ore, gross weight	70,000	71,000	72,000	r67,000	69,000
K_2O equivalent[3]	9,294	9,776	10,367	10,228	10,888
Pyrite, gross weight	6,450	6,100	e5,543	e4,769	e4,893
Salt, all types[3]	16,200	16,500	16,100	15,300	15,400
Sodium compounds, n.e.s.:					
Carbonate[3]	5,099	5,116	e4,916	e5,032	e5,051
Sulfate:					
Natural	360	360	360	360	360
Manufactured	250	250	260	260	260
Sulfur:					
Frasch	800	r900	r960	1,100	1,100
Other native	1,800	1,800	r1,800	r1,900	1,900
S content of pyrite[9]	r2,800	r2,650	r2,421	r2,090	2,150
Byproduct:					
Of metallurgy	r1,600	r1,700	r1,700	r1,700	1,650
Of natural gas	r1,800	r1,850	e1,974	r2,000	2,850
Of petroleum	r350	r350	r350	400	450
Total[10]	r9,150	r9,250	r9,205	r9,190	10,100
Sulfuric acid[3]	24,714	25,338	26,037	27,847	28,531
Talc	510	520	520	520	530
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite	r71,000	r71,000	e71,000	e71,000	e71,500
Bituminous	r486,800	r485,500	r498,000	r517,000	523,500
Lignite and brown coal[3]	158,300	155,800	157,000	163,000	165,000
Total[3 11]	716,100	712,300	726,000	151,000	760,000
Coke: Coke oven, beehive, breeze, gas coke	r170,000	r170,000	e166,900	e154,400	154,000
Fuel briquets:					
From anthracite and bituminous coal	r700	r700	e800	e800	900
From lignite and brown coal	r4,700	r4,700	e4,100	4,100	4,100
Total[3]	5,400	5,500	4,900	4,900	5,000
Gas, natural, marketed:					
As reported[3] million cubic meters	535,700	587,400	643,000	686,000	727,000
Converted million cubic feet	18,900,000	20,700,000	22,700,000	24,200,000	25,700,000
Oil shale[3]	33,256	33,204	32,076	30,099	30,081
Peat:					
Agricultural use	r150,000	r155,000	r155,000	r160,000	160,000
Fuel use[3]	25,700	17,500	16,000	19,500	11,400

See footnotes at end of table.

Table 1.—U.S.S.R.: Estimated[1] production of mineral commodities[2] —Continued

(Thousand metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
MINERAL FUELS AND RELATED MATERIALS — Continued					
Petroleum:					
Crude:					
As reported, gravimetric units[3]	616,343	612,710	595,291	614,753	624,177
Converted, volumetric units thousand 42-gallon barrels	4,530,000	4,500,000	4,380,000	4,520,000	4,590,000
Refinery products[12]	[r]464,630	[r]460,390	[r]447,975	[r]461,334	468,000

[p]Preliminary. [r]Revised.

[1]Production estimated unless otherwise specified.

[2]Includes data available through Sept. 5, 1988.

[3]Reported in Soviet sources.

[4]Reported in United Nations sources.

[5]Estimate based on total of spiegeleisen and blast furnace ferromanganese reported by United Nations sources. The United Nations listing for spiegeleisen appears to include other blast furnace ferroalloys.

[6]Data may not add to totals shown because not all items making up total are listed.

[7]Series changed in 1984 to include near-gem and cheap-gem quality.

[8]Reported series changed to exclude potash. It is assumed that the Soviet series for soda ash prior to 1984 contained a small percentage of potash.

[9]Pyrite series derived from reported Soviet data for pyrite production in gross weight.

[10]Total is based on reported Soviet sulfur production data that excludes byproduct sulfur in sulfuric acid production from metallurgy and sulfur content of pyrites. Data for categories comprising the total, unless indicated, are estimated.

[11]Run-of-mine coal.

[12]Not distributed by type and, therefore, not suitable for conversion to volumetric units. Data include all energy and nonenergy products but exclude losses.

TRADE

The U.S.S.R. reorganized the foreign trade administration, abolishing the Ministry of Foreign Trade and the State Committee for Foreign Economic Relations. A new Ministry of Foreign Economic relations was established, headed by the prior Chairman of the State Committee for Foreign Economic Relations. The Ministry of Foreign Trade had been under criticism for slowness in establishing contacts and cooperation with foreign countries.

Also, in 1987, the Soviet Union created a new bank, the Bank for Foreign Activity, which would handle the country's hard-currency reserves and debt on the international money markets. The new bank would replace the Soviet Bank for Foreign Trade and was created as part of the reform of the foreign trade system to stimulate hard-currency exports. The bank, formed in July, began operations in January 1988. Immediately upon beginning operations, the new bank went public with a $77.8 billion bond issue in Switzerland, which ended a 70-year absence of the Soviet Union from the international public bond markets.

In December, the U.S.S.R. finalized its earlier approval for participation in the United Nations Common Fund for Commodities, designed to stabilize earnings from commodity exports. The Soviet decision made activation of the common fund more certain. Soviet commodity pricing policies were particularly significant for palladium, because the U.S.S.R. provided over 50% of the West's supply.

In trade with the United States, there was a decrease in Soviet exports primarily caused by a reduction in gold bullion exports, which rose to $154.3 million to become the leading Soviet export to the United States in 1986 but fell in 1987 to $371,000, which was more typical of previous years. The decline in gold sales could be partially the result of the recovery of oil prices in world markets, as oil sales traditionally provided the Soviets with the majority of their needed hard-currency earnings.

In October, U.S. exhibitors participated in the oil and gas equipment exposition, Neftegaz 87, in Moscow, which was only the second major U.S. trade exhibit in the U.S.S.R. since official trade promotion was revived in 1985. Forty-four U.S. companies exhibited equipment, and the exhibit mark-

ed the return of U.S. oil and gas field equipment manufacturers to the Soviet market following the expiration in January of U.S. export controls for much of this equipment.

A Connecticut petroleum engineering firm, Combustion Engineering Inc., signed an agreement establishing the first United States-Soviet Union joint venture under a new Soviet law designed to attract foreign investment and technology into the U.S.S.R. The new company, which was to be known by the Russian acronym PRIS, would be involved initially in the installation of instrumentation and control systems for an oil refinery outside Moscow and later would construct a plant in the U.S.S.R. to produce sensors, valves, and other instrumentation for oil refineries. Because profits earned in rubles were nonconvertible, Combustion Engineering Inc. would receive its profits in oil refinery products. Other Western firms, following suit, had negotiated or were negotiating joint ventures with the U.S.S.R. These firms included Occidental Petroleum Corp., which was involved in plans to construct a petrochemical plant and was discussing assisting in oil and gas exploration. In all, in 1987, there were 23 joint ventures and 14 international cartels registered to operate in the U.S.S.R. By yearend, approximately 200 joint ventures were being negotiated and the interest in joint ventures was growing.

As a result of a December meeting, officials of the U.S.S.R. and Iran concluded an agreement whereby Iran would import Soviet mining machinery and aluminum and steel production equipment. This agreement was viewed as part of an effort to improve relations between these two countries.

Table 2.—U.S.S.R.: Mineral trade with the United States in 1987[1]

Commodity[2]		Quantity (metric tons unless otherwise specified)	Value (thousands)
Leading U.S. exports:			
Fertilizers and fertilizer materials[3]		NA	$228,634
Petroleum refinery products:			
Automotive, diesel, marine engine lubricating oils	barrels	168,883	6,290
Aviation engine lubricating oils, excluding jet engine	do	143,506	5,743
Insulating or transformer oils	do	430,983	16,055
Lubricating oils, not specified, except white mineral oil	do	122,231	5,521
Petroleum coke, calcined		114,113	13,637
Titanium compounds, excluding pigment grade	kilograms	4,123,491	7,885
Leading U.S. imports:			
Aluminum: Waste and scrap	do	24,399,288	24,364
Ammonia, anhydrous		738,562	48,634
Ferrosilicon (containing 30% to 60% by weight of silicon, not containing over 2% by weight of magnesium)	kilograms	28,199,215	9,137
Petroleum, crude testing 25 API or more	barrels	1,093,467	18,949
Refinery products:			
Gasoline, leaded	do	257,767	5,665
Napthas, excluding motor oil	do	475,193	8,062
Oils, heavy fuel, testing 25 API or more	do	91,613	9,673
Oils, light fuel, testing 25 API or more	do	641,855	52,743
Platinum-group metals:			
Palladium, Pd content	kilograms	6,981	29,496
Palladium, semimanufacatured, Pd content	do	2,819	11,458
Plattinum sponge, unwrought Pt content	do	434	6,533
Rhodium, Rh content	do	120	48,709
Potassium chloride, crude		149,542	8,781
Uranium compounds, fluorides	kilograms	18,632	11,057

NA Not available.

[1]Exports to the U.S.S.R. reported by schedule B classifications. Imports from the U.S.S.R. by TSUSA items.

[2]Leading items selected based on value in U.S. dollars.

[3]To avoid disclosing company proprietary information, the Bureau of the Census, effective July 1985, established the category "Fertilizers and fertilizer materials" by combining U.S. export data previously contained in other Schedule B classifications. In previous years, the major U.S. export to the U.S.S.R., which would be in the "Fertilizers and fertilizer materials" category, was superphosphoric acid, more than 65% P_2O_5 content. The U.S.S.R. foreign trade statistical compendium Vneshnaya Torgovlya S.S.S.R. 1987 reported that the U.S.S.R. imported 989,000 metric tons of superphosphoric acid from the United States.

Table 3.—U.S.S.R.: Estimated production, trade, and consumption of mineral commodities in 1987

(Thousand metric tons unless otherwise specified)

Commodity	Production	Exports	Imports	Apparent[1] consumption
METALS				
Aluminum:				
Bauxite	4,600	--	5,000	9,600
Nepheline concentrate	[2]1,660	--	--	1,660
Alunite	625	--	--	625
Alumina	3,500	--	1,600	5,100
Metal:				
Unwrought and semimanufactured	2,400	800	--	1,600
Secondary	600	50	--	550
Antimony tons	9,600	500	1,000	10,100
Arsenic, white (As_2O_3) do	8,100	(3)	--	8,100
Beryllium, 10% to 20% BeO do	2,000	(3)	(3)	2,000
Bismuth do	85	--	200	285
Cadmium do	3,000	100	500	3,400
Chrome ore, marketable	[2]3,570	[2]521	--	3,049
Cobalt tons	2,800	--	2,500	5,300
Copper:				
Mine output, Cu content	630	(3)	150	780
Unwrought, unalloyed, semimanufactured	780	200	50	630
Secondary	147	35	(3)	112
Gold thousand troy ounces	8,900	8,900	--	(4)
Iron and steel:				
Iron ore	[2]250,874	[2 5]45,427	(3)	205,447
Pig iron and blast furnace ferroalloys	[2]113,877	[2]5,963	(2)	107,914
Steel:				
Crude	[2]161,887	(3)	(3)	161,887
Rolled	[2]114,081	[2]8,710	[2]5,624	108,995
Pipes	[2]20,346	[2]408	[2]5,167	25,105
Ferroalloys, electric-furnace	2,500	[2]756	[2]30	1,774
Lead:				
Mine output, Pb content	440	--	65	505
Primary	505	50	80	535
Secondary	275	--	--	275
Magnesium metal	90	5	2	87
Manganese concentrate	[2]9,400	[2]714	400	9,086
Mercury 76-pound flasks	67,000	5,000	--	62,000
Molybdenum tons	11,500	(3)	1,200	12,700
Nickel:				
Mine output, Ni content	185	--	16	201
Plant production, Ni content	201	70	4	135
Platinum-group metals thousand troy ounces	3,900	2,100	--	1,800
Silver do	48,200	--	4,000	52,200
Tin:				
Mine output, Sn content tons	16,000	--	1,000	17,000
Primary do	17,000	--	13,000	30,000
Secondary do	4,000	--	--	4,000
Titanium metal do	46,000	5,500	--	40,500
Tungsten do	9,200	(3)	7,200	16,400
Zinc:				
Mine output, Zn content	810	--	95	905
Primary	905	30	50	920
Secondary	110	--	--	110
INDUSTRIAL MINERALS				
Asbestos	[2]2,555	500	(3)	2,055
Barite	540	--	540	1,080
Cement	[2]137,404	[2]2,423	[2]901	135,882
Clays	3,000	(3)	(3)	3,000
Diamond:				
Gem thousand carats	4,400	3,000	(3)	1,400
Industrial stones do	6,400	700	(3)	5,700
Diatomite	255	(3)	(3)	255
Feldspar	340	--	50	390
Fertilizer materials:				
Nitrogen: N content	17,800	6,000	(3)	11,800
Phosphate rock	34,100	3,500	--	30,600
Potash, K_2O equivalent	[2]10,888	[2]2,251	--	8,637
Fluorspar	560	--	630	1,190
Graphite	84	(3)	(3)	84
Gypsum	[2]4,781	(3)	(3)	4,781
Lime, dead-burned dolomite	[2]30,121	(3)	(3)	30,121
Magnesite, marketable	1,875	(3)	[2]578	2,453
Mica	50	--	7	57
Perlite	600	110	--	490
Salt, all types	[2]15,400	[2]452	(3)	14,948
Sulfur, all types	10,100	300	1,200	11,000
Sulfuric acid	[2]28,531	[2]273	150	28,408
Talc	530	(3)	(3)	530

See footnotes at end of table.

Table 3.—U.S.S.R.: Estimated production, trade, and consumption of mineral commodities in 1987 —Continued

(Thousand metric tons unless otherwise specified)

Commodity	Production	Exports	Imports	Apparent[1] consumption
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Anthracite and bituminous	[2]595,000	[2]35,454	[2]9,600	569,146
Lignite and brown coal	[2]165,000	[3]	[3]	165,000
Coke	154,000	[2]2,213	[2]1,327	153,114
Gas, natural million cubic meters	[2]727,000	[2]84,389	[2]1,667	644,278
Oil shale	[2]30,081	--	--	30,081
Peat:				
Agricultural	160,000	[3]	--	160,000
Fuel use	[2]11,400	--	--	11,400
Petroleum:				
Crude	[2]624,177	[2]136,607	[2]13,990	501,560
Refinery products	468,000	[2]59,153	[2]2,160	411,007

[1]Includes amount available for consumption and stockpiling based on 1987 production and trade and excludes consumption from stockpiles from previous years.
[2]Reported in Soviet sources.
[3]Less than 1/2 unit.
[4]Exports equaled or exceeded production.
[5]Includes concentrates and pellets.

Table 4.—U.S.S.R.: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	--	75	--	All to Yugoslavia.
Alkaline-earth metals	34	443	--	France 248; West Germany 150; Belgium-Luxembourg 20.
Aluminum:				
Oxides and hydroxides	--	38	--	All to West Germany.
Ash and residue containing aluminum	34,788	13,731	--	West Germany 7,217; Netherlands 4,327; Italy 2,187.
Metal including alloys:				
Scrap	21,596	43,490	20,111	Finland 13,502; Italy 3,086.
Unwrought	438,724	461,785	5,530	Hungary 198,773; Czechoslovakia 66,000; Japan 64,733.
Semimanufactures	17,841	18,301	--	Yugoslavia 8,053; Poland 6,306; Austria 2,104.
Antimony:				
Oxides	100	46	--	France 36; West Germany 10.
Metal including alloys, all forms	--	538	214	West Germany 157; France 67.
Arsenic: Oxides and acids	--	8	--	All to West Germany.
Chromium:[2]				
Ore and concentrate thousand tons	471	474	19	Czechoslovakia 130; Poland 130; Yugoslavia 76.
Oxides and hydroxides	4,320	4,166	17	Czechoslovakia 799; Yugoslavia 498; Bulgaria 322.
Copper:				
Matte and speiss including cement copper	130	289	--	All to Greece.
Sulfate[2]	23,356	23,208	18	Bulgaria 7,087; Hungary 3,500; Sweden 2,178.
Ash and residue containing copper	644	--		
Scrap	33,865	13,978	--	West Germany 11,424; Switzerland 1,678; Spain 526.
Unwrought	89,066	92,225	--	Czechoslovakia 36,000; Hungary 15,412; Belgium-Luxembourg 11,391.
Semimanufactures	641	3,925	--	Yugoslavia 1,528; Switzerland 1,364; Sweden 461.
Gold:				
Ore and concentrate value, thousands	$37	$86	$86	
Metal including alloys, unwrought and partly wrought do.	$163,419	$345,483	$154,495	Italy $115,138; West Germany $75,738.

See footnotes at end of table.

Table 4.—U.S.S.R.: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite[2] thousand tons	43,880	46,948	--	Poland 14,160; Czechoslovakia 13,354; Romania 9,063.
Metal:				
Scrap[2] do	3,315	4,088	--	Japan 858; Italy 742; Yugoslavia 584.
Pig iron, cast iron, related materials[2] do	4,465	5,517	--	East Germany 1,029; China 587; Bulgaria 377.
Ferroalloys:				
Ferrochromium	6,270	27,333	--	Hungary 7,440; Sweden 5,665; West Germany 5,271.
Ferromanganese	27,855	23,470	--	Hungary 23,384; West Germany 86.
Ferromolybdenum	--	15	--	All to Netherlands.
Ferrosilicochromium	--	249	--	Netherlands 127; Sweden 99; Belgium-Luxembourg 23.
Ferrosilicomanganese	20,448	21,104	--	Romania 19,979; Netherlands 1,125.
Ferrosilicon	22,134	38,009	14,018	Netherlands 11,628; Hungary 7,362; Switzerland 2,319.
Unspecified[2]	569,293	659,820	13,317	Romania 134,021; Czechoslovakia 118,000; Poland 86,000.
Steel, primary forms thousand tons	794	962	--	Hungary 419; Yugoslavia 338; Italy 105.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	715	650	--	East Germany 449; Hungary 150; Yugoslavia 22.
Universals, plates, sheets do	1,492	916	--	East Germany 509; Hungary 235; Bulgaria 73.
Hoop and strip do	12	13	--	Yugoslavia 10; Bulgaria 2.
Rails and accessories do	4	2	--	Mainly to Yugoslavia.
Wire do	5	10	--	Hungary 6; West Germany 2; Yugoslavia 2.
Tubes, pipes, fittings[2] do	420	437	(3)	East Germany 168; China 84; Cuba 67.
Castings and forgings, rough do	11	3	--	Mainly to West Germany.
Unspecified[2]	5,917	6,285	--	Poland 1,825; unspecified 4,460.
Lead: Metal including alloys:				
Scrap	3,889	--	--	
Unwrought	24,605	25,524	262	Finland 6,515; Italy 6,494; Hungary 4,993.
Semimanufactures	20	41	--	All to Yugoslavia.
Lithium: Oxides and hydroxides	25	90	--	Japan 60; Netherlands 20; Spain 10.
Manganese:				
Ore and concentrate, metallurgical-grade[2] thousand tons	1,126	1,101	--	Poland 578; Czechoslovakia 275; East Germany 84.
Metal including alloys, all forms	--	10	--	All to Netherlands.
Mercury 76-pound flasks	--	2,610	--	West Germany 1,827; Sweden 261; France 116.
Molybdenum:				
Ore and concentrate	22	--	--	
Metal including alloys, all forms	--	14	--	All to Greece.
Nickel:				
Matte and speiss	166	197	--	Chile 68; Spain 48; Austria 33.
Metal including alloys:				
Scrap	24	--	--	
Unwrought	27,316	37,330	17	West Germany 15,469; France 4,119; Czechoslovakia 3,971.
Semimanufactures	239	526	--	All to Yugoslavia.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$236,218	$416,319	$81,661	Japan $221,226; West Germany $52,625.
Rare-earth metals including alloys, all forms	107	13	10	West Germany 3.
Selenium, elemental	2	14	--	All to United Kingdom.

See footnotes at end of table.

Table 4.—U.S.S.R.: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Silver:				
Ore and concentrate value, thousands	$215	--		
Waste and sweepings ---do---	--	$888	--	Switzerland $621; Spain $199; West Germany $68.
Metal including alloys, unwrought and partly wrought ---do---	--	$4	$4	
Tellurium, elemental and arsenic	6	20	--	West Germany 10; United Kingdom 6; Belgium-Luxembourg 3.
Tin:				
Oxides	18	--		
Metal including alloys, unwrought	14	5	--	All to West Germany.
Titanium:				
Ore and concentrate	--	12	--	France 10; United Kingdom 2.
Metal including alloys, all forms	1,065	2,897	135	United Kingdom 2,179; West Germany 429.
Vanadium: Ash and residue containing vanadium	--	412	--	All to West Germany.
Zinc:				
Ore and concentrate	5,159	--		
Oxides	250	100	--	All to Yugoslavia.
Ash and residue containing zinc	--	124	--	All to Belgium-Luxembourg.
Metal including alloys:				
Unwrought	12,029	9,953	812	Hungary 5,077; Poland 2,226; Yugoslavia 1,305.
Semimanufactures	--	10	--	All to Greece.
Zirconium: Metal including alloys, all forms	--	2	--	All to West Germany.
Other:				
Ores and concentrates	--	5,214	--	All to Sweden.
Oxides and hydroxides	10	--		
Ashes and residues	76,353	3,081	--	Japan 3,023; United Kingdom 37; France 21.
Base mtals including alloys, all forms	17,570	34,220	1	Czechoslovakia 15,000; Austria 14,062; Poland 5,015.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	1	--		
Artificial:				
Corundum	8,438	7,940	--	West Germany 5,067; France 1,865; Japan 770.
Silicon carbide	6,753	3,196	--	West Germany 2,033; France 526; Italy 402.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$1,937	$1,216	$17	Yugoslavia $543; Italy $414; Belgium-Luxembourg $111.
Grinding and polishing wheels and stones	161	333	--	Finland 252; Philippines 41; Yugoslavia 30.
Asbestos, crude	262,611	237,458	--	Poland 77,005; Japan 36,024; Czechoslovakia 32,653.
Barite and witherite	--	18	--	All to United Kingdom.
Boron materials:				
Crude natural borates	--	1,250	--	All to Japan.
Oxides and acids[2]	11,249	13,426	--	Hungary 1,940; West Germany 774; Yugoslavia 500.
Bromine	179	101	--	All to Hungary.
Cement[2] ---thousand tons---	2,313	2,771	--	China 662; Egypt 630; Saudi Arabia 558.
Clays, crude:				
Chamotte earth	5,534	--		
Kaolin	32,611	30,870	--	Poland 20,622; Yugoslavia 10,076; West Germany 151.
Unspecified	16,017	3,057	--	Hungary 2,457; Austria 403; Finland 192.
Cryolite and chiolite	2	--		

See footnotes at end of table.

Table 4.—U.S.S.R.: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Diamond:				
Gem, not set or strung value, thousands	$353,573	$518,004	$469	Belgium-Luxembourg $348,889; West Germany $60,713; Switzerland $54,278.
Industrial stones do.	$108	$142	$3	Belgium-Luxembourg $93; West Germany $29; Switzerland $17.
Diatomite and other infusorial earth	10	--		
Fertilizer materials:				
Crude, n.e.s	1,452	2,458	--	Canada 2,081; West Germany 277; Yugoslavia 100.
Manufactured:				
Ammonia thousand tons	1,860	1,587	672	Spain 263; Finland 194.
Nitrogenous[2] do.	5,048	5,856	765	China 996; Vietnam 782; Hungary 729.
Phosphatic[2] do.	753	955	--	Cuba 312; Bulgaria 207; Hungary 132.
Potassic[2] do.	5,456	5,127	25	Poland 1,670; Hungary 537; Romania 398.
Unspecified and mixed do.	116	94	(3)	Austria 58; Italy 19; Hungary 17.
Gypsum and plaster	23,553	13,695	--	All to Finland.
Iodine	31	28	--	Hungary 25; Yugoslavia 3.
Magnesium compounds	9,657	7,124	--	Hungary 5,057; Netherlands 1,785; West Germany 282.
Mica: Crude including splittings and waste	--	5	--	All to Finland.
Phosphates, crude thousand tons	2,698	2,610	--	Bulgaria 803; Poland 536; Hungary 453.
Phosphorus, elemental[2]	56,811	55,804	--	Poland 13,716; Romania 11,578; West Germany 1,211.
Pigments, mineral: Iron oxides and hydroxides, processed	449	434	--	All to Yugoslavia.
Potassium salts, crude	--	14,618	--	All to France.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$625	$239	$3	Hong Kong $102; West Germany $72; Italy $24.
Synthetic do.	$826	$732	$1	Austria $401; West Germany $130; Thailand $79.
Pyrite, unroasted[2] thousand tons	294	315	--	Bulgaria 210; Vietnam 60; Hungary 44.
Salt and brine[2]	398,970	418,057	--	Hungary 160,156; Czechoslovakia 150,320; Denmark 74,797.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	24,891	37,082	34	France 20,681; Finland 13,610; Yugoslavia 2,757.
Sulfate, manufactured	29,125	[2]55,299	--	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	9,912	10,478	--	Italy 5,484; Japan 1,659; Yugoslavia 977.
Worked	19	55	6	Finland 42; France 4.
Dolomite, chiefly refractory-grade	--	82	--	All to Sweden.
Gravel and crushed rock	--	6,358	--	All to United Kingdom.
Sulfur:				
Elemental, crude including native and byproduct	33,957	30,174	--	Hungary 28,672; Yugoslavia 1,502.
Sulfuric acid[2]	221,653	230,797	3	Czechoslovakia 214,016; Mongolia 1,778.
Talc, steatite, soapstone, pyrophyllite	1,156	1,275	--	All to Hungary.
Vermiculite, perlite, chlorite	98,395	57,058	--	France 20,204; Belgium-Luxembourg 17,216; Italy 11,292.
Other:				
Crude	42,980	39,527	--	West Germany 19,922; Italy 13,287; Yugoslavia 2,196.
Slag and dross, not metal-bearing	752	5,874	--	All to Japan.

See footnotes at end of table.

Table 4.—U.S.S.R.: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Destinations, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Carbon: Carbon black[2]	98,268	104,674	5	Hungary 29,635; Bulgaria 27,228; East Germany 23,777.
Coal:				
Anthracite and bituminous[2] thousand tons	33,500	33,536	--	Bulgaria 7,198; Japan 5,266; East Germany 4,225.
Briquets of anthracite and bituminous coal do	5	--		
Lignite including briquets do	173	110	--	Yugoslavia 91; Japan 19.
Coke and semicoke[2] do	2,907	2,633	--	East Germany 986; Finland 715; Hungary 542.
Gas, natural: Gaseous million cubic feet	1,496,413	[2]2,795,213	--	West Germany 596,109; Czechoslovakia 375,782; France 309,708.
Peat including briquets and litter	151,845	163,591	--	West Germany 32,216; United Kingdom 28,161; Italy 26,495.
Petroleum:				
Crude[2] thousand 42-gallon barrels	859,950	951,641	558	East Germany 125,442; Poland 100,622; Finland 62,567.
Refinery products:				
Liquefied petroleum gas do	2,677	NA		
Gasoline do	46,543	49,982	--	West Germany 17,930; France 9,706; United Kingdom 9,228.
Mineral jelly and wax do	9	12	--	All to Hungary.
Kerosene and jet fuel do	1,891	1,860	129	Hungary 922; Ireland 394; Netherlands 287.
Distillate fuel oil do	119,131	113,661	--	Netherlands 26,252; West Germany 22,968; Switzerland 12,971.
Lubricants do	1,708	2,405	--	Austria 1,033; Denmark 967; United Kingdom 193.
Residual fuel oil do	100,065	114,493	6,671	Italy 23,052; Belgium-Luxembourg 17,666; Finland 13,870.
Bitumen and other residues do	--	[3]	--	Mainly to Finland.
Bituminous mixtures do	[3]	[3]	--	All to Finland.
Petroleum coke do	1,374	1,230	--	Italy 622; Japan 326; Greece 186.
Unspecified[2] do	100,843	130,982	--	Poland 16,075; unspecified 114,907.

[p]Preliminary. NA Not available.

[1]Table prepared by Jozef Plachy. 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 this country's mineral trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries.

[2]Official Trade Statistics of the U.S.S.R.

[3]Less than 1/2 unit.

Table 5.—U.S.S.R.: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate thousand tons	1,163	866	--	Greece 397; Yugoslavia 387; Jamaica 82.
Oxides and hydroxides ----do----	705	1,094	--	Yugoslavia 534; Hungary 511; Ireland 29.
Metal including alloys:				
Scrap	--	47	--	West Germany 30; United Kingdom 17.
Unwrought	264	344	--	Finland 341; Italy 3.
Semimanufactures	6,458	11,034	2	Hungary 4,952; West Germany 1,528; Austria 1,311.
Cadmium: Metal including alloys, all forms	79	--		
Chromium:				
Oxides and hydroxides	467	--		
Metal including alloys, all forms	--	1	--	All from West Germany.
Cobalt: Metal including alloys, all forms	4	76	--	All from France.
Columbium and tantalum: Ore and concentrate	154	--		
Copper:				
Ore and concentrate	11,209	2,909	--	All from Spain.
Matte and speiss including cement copper	492	--		
Metal including alloys:				
Unwrought	--	47	--	Poland 25; Finland 22.
Semimanufactures	17,915	20,906	10	Poland 12,621; West Germany 3,416; United Kingdom 3,090.
Gold: Metal including alloys, unwrought and partly wrought value, thousands	--	$4	--	All from Japan.
Iron and steel: Metal:				
Scrap	25,688	44,077	--	Mongolia 44,000; Austria 55; Sweden 22.
Pig iron, cast iron, related materials[2]	30,000	30,426	--	Sweden 1,360; West Germany 308.
Ferroalloys:				
Ferromolybdenum	60	7	--	All from United Kingdom.
Ferrosilicochromium	--	701	--	All from Sweden.
Ferrosilicon	3,408	3,540	--	North Korea 3,040; Italy 500.
Silicon metal	9,608	9,999	--	All from Yugoslavia.
Unspecified	18,233	24,915	--	Sweden 3,288; Austria 1,357; United Kingdom 158.
Steel, primary forms	82,391	277,796	--	West Germany 264,846; Italy 6,101; Hungary 4,630.
Semimanufactures:				
Bars, rods, angles, shapes, sections ----- thousand tons	1,053	928	--	Czechoslovakia 358; Hungary 196; Japan 81.
Universals, plates, sheets do	3,691	2,456	--	West Germany 809; Austria 348; Japan 299.
Hoop and strip ------do----	213	172	--	West Germany 124; Japan 17; Italy 12.
Rails and accessories ---do----	(3)	2	(3)	United Kingdom 1.
Wire ------------do----	22	9	--	Hungary 4; Yugoslavia 2; West Germany 1.
Tubes, pipes, fittings[2] --do----	5,141	5,676	(3)	Japan 1,972; West Germany 1,341; Italy 629.
Castings and forgings, rough do	6	8	--	Italy 5; Finland 2; West Germany 1.
Unspecified[2] --------do----	2,021	1,879	--	NA.
Lead:				
Ore and concentrate	29,245	22,817	--	Spain 9,869; Ireland 3,629; Sweden 3,200.
Oxides	2,498	3,355	--	France 2,850; United Kingdom 380; Switzerland 120.
Metal including alloys:				
Unwrought	62,059	5,628	--	Sweden 5,155; Yugoslavia 466; Finland 5.
Semimanufactures	17	642	--	Canada 600; Yugoslavia 31; Finland 6.
Magnesium: Metal including alloys, unwrought	1,952	--		
Manganese:				
Ore and concentrate, metallurgical-grade	--	1,982	--	All from Netherlands.
Oxides	527	7,250	--	Japan 5,200; Greece 2,050.

See footnotes at end of table.

Table 5.—U.S.S.R.: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Molybdenum: Ore and concentrate	69	--		
Nickel:				
Matte and speiss, Ni content	65	--		
Oxides and hydroxides	3,050	--		
Ash and residue containing nickel	560	500	--	All from Greece.
Metal including alloys:				
Unwrought	1	10	--	All from Japan.
Semimanufactures	545	24	(3)	Sweden 15; France 9.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$52	$1,081	$1,038	Switzerland $39; Japan $3.
Silver:				
Ore and concentrate do	--	$110	--	All from Canada.
Waste and sweepings[4] do	--	$134	--	All from Switzerland.
Metal including alloys, unwrought and partly wrought do	$881	$320	--	West Germany $310; Belgium-Luxembourg $7; Switzerland $2.
Tin:				
Ore and concentrate	2,020	427	--	Hong Kong 265; Netherlands 162.
Metal including alloys:				
Unwrought	11,474	7,017	--	United Kingdom 4,952; Netherlands 2,000;; Belgium-Luxembourg 65.
Semimanufactures	2	--		
Titanium:				
Ore and concentrate	3,400	5,000	--	All from Netherlands.
Oxides	3,446	2,659	--	West Germany 2,100; United Kingdom 236; Spain 176.
Tungsten:				
Ore and concentrate	1,022	1,415	--	All from Hong Kong.
Metal including alloys, all forms	43	--		
Zinc:				
Ore and concentrate	63,727	54,920	--	Sweden 27,075; Canada 17,578; Spain 10,267.
Oxides	1	105	--	United Kingdom 100; Finland 5.
Blue powder	518	1,584	--	Yugoslavia 987; Spain 596; United Kingdom 1.
Metal including alloys:				
Unwrought	24,026	12,945	--	Italy 7,944; Finland 3,001; Spain 2,000.
Semimanufactures	9,119	1,183	--	Poland 909; Finland 184; Yugoslavia 58.
Zirconium: Ore and concentrate	--	3,750	--	All from Netherlands.
Other:				
Ores and concentrates	91,961	28,065	--	Norway 17,064; Australia 11,001.
Oxides and hydroxides	105	--		
Ashes and residues	1,021	18	--	All from Italy.
Base metals including alloys, all forms	2,083	426	--	Japan 322; Finland 104.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	6	144	2	Yugoslavia 140; Italy 2.
Artificial: Corundum	3,157	4,049	--	Hungary 2,009; West Germany 1,468; Japan 570.
Dust and powder of precious and semiprecious stones including diamond value, thousands	--	$851	--	All from Canada.
Grinding and polishing wheels and stones	1,829	3,576	2	Japan 760; Austria 755; France 584.
Asbestos, crude	--	474	474	
Barite and witherite	74,946	19,600	--	Yugoslavia 14,600; Morocco 5,000.
Cement thousand tons	[2]945	[2]1,110	(3)	Poland 399; Hungary 28; unspecified 434.
Clays, crude:				
Kaolin	20	3	--	All from United Kingdom.
Unspecified	63	457	--	Italy 455; Denmark 2.
Diamond:				
Gem, not set or strung value, thousands	$7,562	$2,893	--	Switzerland $2,876; United Kingdom $17.
Industrial stones do	$481	$662	$3	United Kingdom $510; Belgium-Luxembourg $138; Switzerland $11.
Diatomite and other infusorial earth	191	108	--	Belgium-Luxembourg 85; United Kingdom 22; Denmark 1.

See footnotes at end of table.

Table 5.—U.S.S.R.: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Feldspar, fluospar, related materials:				
Feldspar	23,200	NA		
Fluorspar	37,528	NA		
Unspecified	129	32,280	--	Thailand 32,000; Finland 280.
Fertilizer materials: Manufactured:				
Ammonia	--	1	--	All from France.
Nitrogenous	50,433	[2]30,000	--	All from Afghanistan.
Phosphatic[2]	702,725	826,400	--	Turkey 287,300; Morocco 274,800; Tunisia 77,900.
Potassic	50	--		
Unspecified and mixed	16,442	57,615	--	Yugoslavia 55,281; Italy 2,241; Austria 93.
Gypsum and plaster	46	37	--	Yugoslavia 30; Finland 7.
Iodine	--	65	--	United Kingdom 50; France 15.
Lime	23	205	--	Yugoslavia 126; Austria 76; West Germany 3.
Magnesium compounds:				
Magnesite, crude	76	31	13	Yugoslavia 18.
Oxides and hydroxides	21,655	661,770	--	North Korea 626,000; Czechoslovakia 32,000; West Germany 1,220.
Mica: Worked including agglomerated splittings	1	--		
Phosphates, crude	--	49,279	--	Morocco 49,278; West Germany 1.
Pigments, mineral: Iron oxides and hydroxides, processed	1,110	910	--	All from Japan.
Precious and semiprecious stones other than diamond, synthetic value, thousands	$304	$58	--	Japan $37; West Germany $21.
Pyrite, unroasted	1	--		
Salt and brine	60	14	--	Italy 8; Finland 6.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	522,181	518,731	--	Bulgaria 473,238; Poland 45,483; Italy 10.
Sulfate, manufactured	--	31	--	All from Japan.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	8,638	7,120	--	Hungary 7,061; Italy 30; Sweden 24.
Worked	517	1,401	--	Finland 690; Yugoslavia 673; Italy 20.
Dolomite, chiefly refractory-grade	24	--		
Gravel and crushed rock	2,498	14,897	--	Sweden 10,530; Yugoslavia 3,814; Finland 550.
Quartz and quartzite	445	40	--	Finland 24; Austria 15; West Germany 1.
Sand other than metal-bearing	40	1,977	--	Finland 1,908; Yugoslavia 68; Spain 1.
Sulfur:				
Elemental, crude including native and byproduct thousand tons	1,162	1,719	--	Poland 871; Canada 848.
Dioxide	16	--		
Sulfuric acid	98,178	98,844	--	Poland 97,975; Japan 831; Hungary 36.
Talc, steatite, soapstone, pyrophyllite	1,035	1,469	--	All from Finland.
Other:				
Crude	1,211	2,941	--	Hungary 2,599; Yugoslavia 225; Sweden 117.
Slag and dross, not metal-bearing	115	429	--	Finland 400; France 29.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2,369	1,656	--	Finland 1,654; Yugoslavia 2.
Carbon: Carbon black	[2]533	54,021	113	Argentina 52,831; West Germany 973.
Coal:				
Anthracite and bituminous[2] thousand tons	10,300	11,800	--	All from Poland.
Lignite including briquets do.	17	--		
Coke and semicoke[2] do.	1,076	720	--	Do.
Gas, natural: Gaseous[2] million cubic feet	85,532	78,398	--	NA.
Peat including briquets and litter	55	--		

See footnotes at end of table.

Table 5.—U.S.S.R.: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude[2]				
thousand 42-gallon barrels	90,520	110,709	--	NA.
Refinery products:				
Liquefied petroleum gas				
42-gallon barrels	626	1,531	(3)	Finland 1,032; France 487; Austria 12.
Gasoline ---do---	94,197	358	--	United Kingdom 264; Finland 85; Yugoslavia 9.
Mineral jelly and wax ---do---	1,865	2,306	--	Netherlands 1,338; West Germany 866; Italy 63.
Kerosene and jet fuel ---do---	24,389	29,435	--	Yugoslavia 28,660; West Germany 395; Italy 209.
Distillate fuel oil ---do---	649,736	219,190	--	Sweden 173,326; Argentina 21,813; Yugoslavia 6,811.
Lubricants ---do---	1,777,720	2,217,213	906,575	Finland 302,645; France 289,674.
Residual fuel oil ---do---	273,060	275,764	--	Greece 105,468; Spain 93,740; Sweden 31,762.
Bitumen and other residues ---do---	14,411	17,326	--	Hungary 8,605; Finland 8,030; Austria 473.
Bituminous mixtures ---do---	697	3,503	--	Yugoslavia 1,988; Finland 915; Sweden 333.
Petroleum coke ---do---	1,169,108	776,270	581,559	Japan 141,642; United Kingdom 36,031.
Unspecified[2]				
thousand 42-gallon barrels	11,333	11,240	--	NA.

[p]Preliminary. NA Not available.

[1]Table prepared by Jozef Plachy. 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 this country's mineral trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries.

[2]Official Trade Statistics of the U.S.S.R.

[3]Less than 1/2 unit.

[4]May include other precious metals.

Table 6.—U.S.S.R.: Estimated net exports of selected minerals and metals as a percent of consumption in 1987[1]

Commodity	Percent of consumption
Aluminum	50
Asbestos	24
Chromium ore	17
Diamond, gem	200
Gas, natural	13
Gold	(2)
Iron ore and concentrate	22
Mercury	8
Nickel	52
Nitrogen	51
Perlite	22
Petroleum:	
Crude	25
Refinery products	14
Platinum-group metals	117
Potash	26
Titanium metal	14

[1]Selection made from commodities for which exports make up 5% or more of consumption. Includes consumption of secondary metal.

[2]Exports equaled or exceeded production.

Table 7.—U.S.S.R.: Estimated net import reliance of selected minerals and metals as a percent of consumption in 1987[1]

Commodity	Percent of consumption	Principal sources
Barite	50	Bulgaria, North Korea, Yugoslavia.
Bauxite and alumina	60	Greece, Guinea, Hungary, India, Jamaica, Japan, Yugoslavia.
Bismuth	70	NA.
Cadmium	12	NA.
Cobalt	47	Cuba, Zaire.
Feldspar	13	Thailand.
Fluorspar	53	China, Mongolia, Thailand.
Iron and steel, high-quality products	8	Austria, Belgium-Luxembourg, France, West Germany, Italy, Japan, Spain.
Lead	12	Argentina, Bulgaria, Greece, Peru, Spain, Sweden, Turkey.
Magnesite, marketable	24	North Korea.
Mica	12	India.
Molybdenum	9	Mongolia.
Silver	8	Switzerland, United Kingdom.
Sulfur	8	Poland.
Tin	41	Malaysia, Singapore, United Kingdom.
Tungsten	43	China, Mongolia, North Korea.
Zinc	11	Bulgaria, Finland, Greece, Poland, Spain, Sweden, Turkey.

NA Not available.
[1]Includes consumption of secondary metal.

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Aluminum.—The Tadzhik aluminum plant, which along with the Sayansk plant was one of two new aluminum plants being constructed in the Soviet Union, reported fulfilling its annual production target. This could be an indication that the Tadzhik plant was overcoming the many difficulties it had experienced since its commissioning. Plans called for the Kanaker aluminum plant in Armenia to increase production of foil for the electronics and food processing industry by 30% by 1990 in comparison with 1985. Kanaker ceased producing primary aluminum in 1984 for environmental reasons but continued to produce foil, wire, and other fabricated products.

The Soviet aluminum industry had to depend on imports for more than 50% of its raw materials. Some progress was reported in 1987 in developing bauxite production at the Severouralboksitruda Association, which had been in operation in the Urals since the mid-1930's. It had gone from a small operation to its current state of five large underground mines, 500 to 700 meters deep, and one open pit. The association was undergoing extensive renovation that had been neglected in earlier years. However, owing to the complex mining conditions at the association, with the depth of mines increasing up to 22 meters per year, an increase in ore extraction would not be possible for several years and significant production increases were not foreseen at this association. To increase bauxite production, new deposits would have to be developed to provide for the country's need for aluminum raw materials.[14]

A method the Soviets were using to increase aluminum raw material production was to use the nonbauxite materials nepheline and alunite. The apatite complex on the Kola Peninsula produced about 1.6 million tons per year of nepheline for use in alumina production, but millions of tons of nepheline were accumulating in dumps that were viewed as an additional raw materials source.[15] In addition to nepheline, alumina was also produced from alunite in Azerbaidzhan, and in 1987, planned additional capacity for alumina production from alunite ore reportedly was commissioned at the Kirovabad alumina plant.

To augment the aluminum raw material supply and reduce the cost of aluminum production, greater use was being made of secondary material. The percentage of aluminum produced from secondary material was in the neighborhood of 20% of total aluminum production. Production of secondary aluminum occurred at metallurgical plants with capacities ranging between 22,000 tons to 180,000 tons per year.

Chromium.—In 1987, the Soviets pro-

duced nearly 3.6 million tons of marketable chrome ore.[16] At the Donskoy complex in Kazakhstan, which produced more than 95% of the country's chrome ore, five of the six open pits had been or were being renovated and the crushing-beneficiation plant No. 1, the country's largest for chrome ore beneficiation, was being renovated, raising its capacity from 575,000 tons per year to 615,000 tons per year. The renovation of the open pits at the Donskoy complex was lengthening their expected production life an average of 3 to 5 years. Development of the new Molodezhnaya underground mine at Donskoy was proceeding. In September 1986, the first stage reached its projected capacity for producing 800,000 tons per year of crude chrome ore; the first stage began operation in 1982.

In the U.S.S.R. three bichromate plants were in operation, the Aktyubinskiy, Novotroitskiy, and Pervoural'skiy. Products from these plants were consumed domestically and exported to a large number of countries including France, Italy, Japan, and the United Kingdom.

Cobalt.—At the Ufaley nickel complex in the Urals, where cobalt production began in 1936, cobalt was extracted from concentrates transported from the Severonikel complex on the Kola Peninsula and the Tuva cobalt complex in East Siberia; this required long-distance shipment from both locations to Ufaley. Cobalt production at Ufaley had increased greatly since 1946, increasing 4 times by 1950, 7.5 times by 1970, 30 times by 1965, and 130 times by 1986. During the 1986-90 period, plans called for the Ufaley complex to increase cobalt production by 40% by 1990 in comparison with 1985. To do this it would be necessary to add additional equipment.[17]

Copper.—The Soviet copper industry was faced with the problem of decreasing ore grades at its major working deposits. The copper content of ore in Kazakhstan, the major copper-producing region of the country, has decreased by 50% in the past 15 years.[18] Development of the copper industry was, nevertheless, proceeding in Kazakhstan. At the Balkhash copper complex in Kazakhstan, it was planned to commission the second autogenous fluidized bed smelter (PZhV) by yearend. The first PZhV smelter was commissioned at Balkhash in 1985, but only began operating smoothly during the latter part of 1986. The switch to PZhV smelters was considered critical for maintaining production levels at Balkash, where lower ore and concentrate grades for domestic and imported materials had led to a significant reduction in production capacity for reverberatory smelting and conversion. During the first 7 months of 1987, the Balkhash complex increased production of blister copper by 10% in comparison with the comparable period in 1986.[19]

Reportedly, at the Dzhezkazgan copper complex in Kazakhstan, the plan for 1986 and the first half of 1987 was fulfilled. Plans for Dzhezkazgan for the 1986-90 period called for ore extraction to increase by 11% by 1990 in comparison with 1985. During the 1986-90 period, large capital investment was to be made at Dzhezkazgan. Plans called for commissioning the first stage of the Akchiy-Spasskiy Mine and the No. 3 beneficiation plant for the Annenskiy Mine, as well as a significant investment in equipment and renovation.

In Armenia, at the Alaverdi copper complex, plans called for putting back into operation the Lenin mines, which were abandoned after World War II because of flooding. At the Moscow copper smelter and refinery, a new foil production line was commissioned.

Ferroalloys.—In recent years, the Soviets greatly increased exports of regular-grade 50% ferrosilicon after significantly expanding production capacities at the Yermak ferroalloy plant in Kazakhstan. In August, the European Economic Community decided to impose an antidumping duty of 59 European currency units per ton on imports of Soviet ferrosilicon after having found a dumping margin of 10.7%. Despite increased production of some ferroalloys, the country reported a shortage of ferrovanadium.[20]

Although the Kuznetsk ferroalloy plant began production of ferrosilicovanadium in 1981, it was claimed that because of technicalities the plant was not producing this product in accordance with Government specifications. The plant, which was producing 1,500 tons per year of ferrosilicovanadium, was told that it was no longer allowed to supply its customers. The plant had 7 customers, including some of the largest truck and machinery manufacturing plants in the country with 12 additional customers applying for orders at the time. The Kuznetsk plant was protesting the injunction, which was apparently requiring that the plant curtail or cease producing ferrosilicovanadium until it was produced in accordance with Government established legal specifications, which it

was claimed, had still not been provided to the plant. The head of the technical division at the Kuznetsk plant stated that this Government injunction would adversely affect the country's machinery manufacturing capability.[21]

Germanium.—At the end of the 1940's, the Soviets began to seek reserves and to organize production of germanium for semiconductor devices. Within the first years after its exploration began, the country was able to find adequate reserves to supply domestic demand and cease imports. Then, in 1966, the U.S.S.R. began exporting germanium. Unlike market economy countries, which produced germanium from processing zinc, the main source of germanium production in the U.S.S.R. was coking coal from the Donets Basin (Donbas) in the Ukraine. Germanium production from the Donbas was based on coal tar and coking residues. The Soviets also had a recycling program for germanium. For future sources of germanium, the Soviets were considering iron ores, flue dusts, and fly ash as well as improved recycling.[22]

Gold.—The 1986-90 plan called for a sharp increase in gold production, although the complaint was raised that there were no specific plans concerning how this increase was to occur. Furthermore, it was argued, important gold deposits were not included for development in the new plan.[23] It appeared that Soviet gold sales in 1987 were reduced in comparison with 1986, which could be attributable in part to increased hard-currency earnings from oil exports, enabling the Soviets to meet their hard-currency earning targets with reduced gold sales.

Although the Soviets reported planning increases in gold production for the 1986-90 period, specific data on gold production and sales had been secret for decades. When the general manager of the Vneshekonomobank, the U.S.S.R.'s only legally authorized institution for selling gold abroad, was asked about the possibility of the Soviets publishing gold statistics, he replied "What is the benefit, if figures are better than thought, it will be interpreted as the Soviet Union selling and this would be bad for the gold price. If figures were less than estimates you say, our credit rating is questionable."[24] Regarding the effects of the policy of restructuring on gold sales, he declared that perestroika "can afford us to assume that the Soviet Union will possess more room for maneuver while deciding at what particular moment and what quantity of gold should be sold depending on the market conditions."[25]

Increases in gold production in recent years occurred primarily from the artels, which were collective groups of workers acting much as private entrepreneurs. Much criticism was directed in the Soviet press toward these artels, which originally were intended to mine areas that were uneconomic and inaccessible for the state enterprises using large equipment. However, the artels, it was claimed, through a system of corruption that allowed numerous individuals to amass large sums of money, had taken over the development of major rich deposits and were mining these deposits using expensive modern equipment, often imported from the West. The artels were also accused of poor mining practices, allowing gold losses up to 15% to 20% more than was the norm for state enterprises.[26]

In 1987, the Severovostok Zoloto (North East Gold) Mining Association, one of the country's major producers, reported fulfillment of its 1987 gold extraction plan in October, producing in excess of the plan for the rest of the year. During the 1986-90 period, plans called for completing development of the Kirgiz gold mining complex, the first stage of which was commissioned in 1985. Development was by open pit mining.

In 1987, the U.S.S.R. reportedly was considering plans to reopen the El Limon gold mine in Nicaragua. Also, the U.S.S.R. provided gold mining equipment to Nicaragua to enable it to increase its current level of gold production. In 1987, the U.S.S.R. changed its policy regarding gold sales to Japan and began selling gold to Japanese trading houses on a consignment basis rather than through spot sales.

Iron Ore.—In 1987, iron ore production increased slightly, fulfilling the plan. A total of 544 million tons of crude iron ore was extracted to produce 251 million tons of marketable iron ore, from which 194.5 million tons of concentrate and 67.5 million tons of pellets were produced. The plan for marketable iron ore production was exceeded by 3.2 million tons, for concentrate by 1.7 million tons, and for pellets by 1.5 million tons. Despite decreasing ore grades, the iron content of marketable ore increased from 59.7% in 1986 to 60.01% in 1987. The plan for 1988 called for increasing the percentage of production of concentrate with an iron content of 65% and higher.

In 1987, 470 million tons of crude iron ore was extracted from open pits, accounting for 86.4% of total extraction. The concentration of production at a few large open pits continued. In 1987, seven large open pits produced 235 million tons of ore equaling 50% of total open pit extraction in comparison with 45% in 1986. Open pits with a capacity of more than 10 million tons per year, although representing only 30% of open pits, accounted for over 85% of total production.

The U.S.S.R. was confronting the problem of low-grade iron ore reserves. Of total reserves in 1985, 51.3% was of lower grade iron quartzites. The iron ore reserves are unevenly distributed, with 78% of explored reserves in the European part of the country and 22% east of the Urals. The deficiency of local reserves in the eastern part of the country necessitated hauls of up to 4,500 kilometers.

Regarding equipment, the average capacity of shovels increased from 6.78 cubic meters in 1986 to 7.2 cubic meters in 1987. Shovels with a capacity of more than 6 cubic meters comprised 35% of the total. The average capacity of dump trucks increased from 37.8 tons in 1980 to 63.8 tons in 1986. Because mining depths would increase, plans called for greater utilization of rail transport in open pits, particularly at depths below 300 meters.

In 1987, 39 underground mines extracted 75 million tons of crude ore, and mines with a capacity of more than 2 million tons per year accounted for 80% of this production. Underground mining reached depths of 800 to 1,000 meters and new horizons for development were at depths of 1,200 to 1,400 meters. Mines in the Krivoy Rog Basin in the Ukraine accounted for almost one-half of the ore mined underground. Owing to the depletion of high-grade ore, more underground mining was being conducted of lower grade iron quartzites. In 1987, mines in the Krivoy Rog Basin extracted 8.7 million tons of these lower grade iron quartzites.

The goal for the U.S.S.R. iron ore industry to the year 2000 was to maintain production at near the current level despite increasing depths of workings and reliance on lower grade ores. To achieve this would require an increase in labor productivity in open pit mines, primarily through improved transportation systems such as rail transport and large-scale dump trucks. In underground mining, production was to be maintained through the wide-scale use of mobile drilling units as well as introducing improved stoping methods such as bulk mining systems involving bulk ore and rock caving, induced block caving, and sublevel caving methods.

In 1987, iron ore production in the Ukraine, which contains the Krivoy Rog Basin, the country's largest iron ore producing region, decreased by 2% to 118 million tons of marketable ore, equaling 47% of the country's total output. Owing to depleting reserves and more difficult mining conditions, plans for the 1986-90 period called for a 50% increase in investment at Krivoy Rog just to sustain output levels.

Given decreased output in the Ukraine, production must have increased in other regions of the country to account for increased national production. In Kazakhstan, where the Kachar iron ore mining and beneficiation complex was being developed, production of marketable iron ore increased by about 700,000 tons. Also, a number of mines in the country's second largest iron ore producing region, the Kursk Magnetic Anomaly (KMA), reported producing in excess of their plan.

The KMA produced almost 20% of the country's marketable iron ore, including both rich dried shipping ore and concentrate from low-grade iron quartzites. Major capacity expansion for iron ore extraction and concentrate production occurred at the Lebedi mining and beneficiation complex in Belgorod Oblast' in the Kursk Magnetic Anomaly. In the KMA, at the beginning of 1987, the production capacities shown in table 8 were reported at three open pit mining and beneficiation complexes.

Table 8.—Capacity at open pit mining and beneficiation complexes in the Kursk Magnetic Anomaly (KMA)

(Million metric tons per year)

Mining complex	Crude ore	Concentrate	Pellets
Lebedi	45.0	19.9	8.7
Mikhaylovskiy	34.3	18.6	6.2
Stoylensk	8.0	5.4	NA

NA Not available.

Source: Shakhtnoye stroitel'stvo (Mine Development) (Moscow). No. 7, July 1987, p. 3.

Iron and Steel.—The concern was expressed in the Soviet press that although the U.S.S.R. was the world's largest steel producer, there was a constant shortage of steel in the country.[27] The U.S.S.R. reportedly consumed twice as much steel per unit

of national income produced as did the United States.[28] Plans for the year 2000 called for reducing steel consumption per unit of national income produced by 50% in comparison with 1986.

In 1987, production of pig iron, raw steel, rolled steel, and steel pipes increased compared with the 1986 level, fulfilling the plan. However, the U.S.S.R. was currently engaged in a program to concentrate more on producing specialized steels needed to modernize the economy, many of which were being imported, rather than just increasing steel output. In 1987, the plan was fulfilled for the production of only 6 of 25 types of special high-grade steel products. Major items for which the plan was not fulfilled included steel produced in electric arc furnaces, continuously cast billets, cold-rolled steel and stainless steel, high-grade cold-drawn steel, and oil-grade high-impact pipes.

Despite ambitious plans to produce 85% of steel output by continuous casting by the year 2000, in 1987, continuous casting accounted for only 16.1% of raw steel produced. Also, in 1987, open-hearth furnace production accounted for 53% of steel production, oxygen converter furnace production 33%, and electric-furnace production 14%; it was planned by the year 2000 to practically phase out open-hearth production.

There were 15 oxygen converter steel plants operating in the country, with 45 converters, 11 of which had a 200- to 350-ton capacity. Plans called for increasing the amount of oxygen converter steel production to 65 to 70 million tons by 1990, with the introduction of new oxygen converter complexes at the Magnitogorsk, Kuznetsk, and Zaporozh'ye steel complexes to replace open-hearth furnaces. The new oxygen converter complex at Magnitogorsk, the first stage of which was scheduled to begin operations in 1989 with a capacity of 5 million tons per year, was considered one of the most important projects of the 1986-90 plan period. By 1990, it was planned that oxygen converters would account for 45% of steel production in comparison with 33% in 1987.

During the 1986-90 period, capital stock in the ferrous metallurgy sector would be modernized at twice the rate of the past 15 years. Much equipment in the steel industry was outmoded and had been in service long in excess of its calculated depreciation time. For blast furnaces, the average length of service was 49 years in comparison with the established standard depreciation time of 25 years, for open-hearth furnaces it was 41 years in comparison with 20 years, and for oxygen converter furnaces 28 years in comparison with 20 years. During the 1986-90 period, plans called for retiring 19 outmoded blast furnaces and renovating 32 others, and overhauling 30 coking batteries and relining 27 others.

The plan for iron and steel production for 1988 did not call for a significant increase in output of pig iron, crude steel, and rolled steel. Plans for 1988 did call for increasing production of quality steels including low-alloy, heat-hardened, and cold-rolled steels. The goal was also set to begin producing a number of types of steel products that had to be imported.

In 1987, after a 10-year absence of data, the Soviets again began publishing data on exports and imports of rolled steel and steel pipe. In 1987, the Soviets were net importers of rolled steel and steel pipe, with imports of rolled steel and pipe totaling more than 10 million tons while exports of rolled steel and pipe were less than 9 million tons. Much of the Soviet imports were high-quality steel products not produced domestically in adequate quantities.

Iron powder production occurred at three plants, the Sulinskiy metallurgical plant, the Brovarskiy powder metallurgy plant, and the Sibelektrostal steel plant, with the first two being the main producers of iron powders, having significantly increased production capacity and the product quality in recent years. During the 1989-90 period, plans called for adding production capacity at Brovarskiy and Sulinskiy. During the 1981-85 plan period, production of iron powders increased at an annual rate of 5.9% and during the 1986-90 plan period, was increasing at an annual rate of more than 10%. In 1986, 81.5% of the iron powders produced was used in manufacturing parts and about 16% in producing welding rods and wires.

In international trade, Bethlehem International Engineering Corp. (BIEC), the Galvalume process licenser, in conjunction with Belgium's Cockerill Mechanical Industries, signed an agreement to set up a Galvalume production line at the Cherepovets steel mill. The line would be a 320,000-ton-per-year dual-capacity line for producing Galvalume and aluminum coated sheet.

Production was scheduled to begin in 1989.

The West German Krupp Polysius AG contracted to supply a slag grinding plant to the Karaganda steelworks. Included would be five small crushers, magnetic separators, trippers, and filters for dust capture, with startup scheduled for 1990. The U.S.S.R. agreed to construct a steel mill in Zambia at Mumbwa, approximately 135 kilometers west of the capitol of Lusaka. The mill would use iron ore from a deposit near Nampundwe that was not currently being mined and would use local high-sulfur coal.

Lead and Zinc.—In Kazakhstan, which produced 70% of the country's lead and 50% of the country's zinc, new capacity for mixed sulfide ore extraction was reported added at the Zhayrem lead-zinc complex and the Leninogorsk polymetallic complex. At the Zhayrem complex, the first stage of which was put into operation in 1978, plans for the 1986-90 period called for developing a "second Zhayrem," that is doubling capacity for lead-zinc extraction. Given the existing labor shortage, this goal would most likely be achieved by utilizing more efficient equipment.

In the U.S.S.R., used lead storage batteries provided for 80% of the raw material for secondary lead production. The remainder came primarily from lead ores, dross, pastes, dusts, alloys, and chip and cable sheath. Over 70% of secondary lead raw materials was processed at plants specializing in the production of antimonial lead of various qualities. The remainder was processed along with sulfide raw materials to produce refined lead. Up to 77% of all lead produced went into storage batteries, and plans called for a considerable increase in the use of secondary raw materials, particularly storage batteries, for the production of secondary lead. However, increasing demands for environmental protection were necessitating improving existing procedures and creating new procedures for processing battery scrap. The largest secondary lead smelter was the Ukrzink smelter in the Ukraine. The smelter produced six types of antimony lead alloys. The recovery of lead and antimony from secondary raw materials was reportedly 96%.

The plan for 1986-90 called for rapidly expanding the use of autogenous smelters. At the Ust'-Kamenogorsk lead-zinc plant in Kazakhstan, where the first Kivcet-CS autogenous smelter was installed, plans were proceeding to convert the plant completely to autogenous smelting. The Soviets developed the Kivcet-CS autogenous flash process for smelting lead and zinc concentrates, and plans called for continuing installing Kivcet-CS smelters at lead-zinc enterprises.

The first Kivcet unit to begin operations outside the U.S.S.R. was commissioned by Italy's Nuova Samim at a lead smelter at Porto Vesme, Sardinia, with a capacity to produce 85,000 tons per year of 97% lead bullion from 120,000 to 130,000 tons of lead concentrate. The Kivcet process was a single-stage process that involved no sintering, did not require a large amount of coke, and produced only a small volume of sulfur-dioxide-rich gas. Nuova Samim stated that it added a number of special features to the Kivcet process, which reduced raw material costs and improved byproduct recovery. Another Kivcet unit was scheduled to begin operations in Brazil in 1988. As part of an agreement with Turkey to pay for Soviet natural gas imports with goods, Turkey sent to the Soviet Union lead, lead-acid storage batteries, and zinc concentrate as part of its payment.

Manganese.—Manganese production reportedly increased slightly above its 1986 level to 9.4 million tons of manganese concentrate, with increasing production in the Nikopol' Basin being offset by declining production in the Chiatura Basin. However, for the first time, the Soviets stopped reporting the manganese content of the concentrate, indicating that possibly the total manganese content of concentrate remained the same or decreased. In 1987, manganese production in the Nikopol' Basin in the Ukraine, which produced more than 70% of the country's total manganese output, increased by 1% over that of 1986 to 7.2 million tons of manganese concentrate after 2 years of declining production.[29] However, manganese production in the Chiatura Basin in Georgia, which was the major source of the country's high-grade manganese ore, continued its decline, falling by 4% to about 2.1 million tons.[30] Production at Chiatura had fallen by 25% in only the past 3 years. Although manganese ore output remained at its 1986 level, exports of manganese ore decreased by 35% below that of 1986 to 714,000 tons. Decreasing production of high-grade ore had forced the Soviet Union in recent years to import several hundreds of thousands of tons per year of high-grade ore from the West for blending purposes while still exporting ore and ferromanganese to CMEA countries.

Increased production at the Nikopol' Ba-

sin could be attributed in part to the commissioning in 1987 of the first stage of the Tavricheskiy mining and beneficiation complex, which exploited the Bol'shoy Tokmak deposit where the majority of ore is low-grade carbonate ore. Annual capacity at Tavricheskiy was planned to increase from about 300,000 tons of manganese concentrate in 1987 to 600,000 tons in 1990. The Soviets were working to improve their technology for beneficiating low-grade carbonate ore because this type of ore was becoming a more important source of raw material at both the Nikipol' and Chiatura Basins.[31]

In addition to developing carbonate ore deposits, plans for the 1986-90 period called for expanding production of oxide ore from the Ushkatyn open pit in Kazakhstan, which was under development as part of the Zhayrem lead-zinc complex. Although deposits in Kazakhstan were producing less than 5% of the national output of manganese in 1987, explored manganese reserves in Kazakhstan were considered to be among the largest in the country.

In 1987, the U.S. Bureau of Mines published a comprehensive report on the Soviet manganese industry, dealing with reserves, mining, processing technology, ferroalloy production, and trade that can be obtained by writing the Division of International Minerals, Soviet Union Specialist, U.S. Bureau of Mines, 2401 E Street NW., Washington, DC 20241.

Nickel.—Uncertainty regarding Soviet nickel sales to market economy countries corresponded with a shortage of nickel, along with a concomitant rise in nickel prices, which was attributed, in part, to a perceived decrease in Soviet exports. However, in actuality, reported Soviet nickel sales to market economy countries increased in 1987. During 1987, the Soviets were diversifying their marketing channels to the West, moving toward producing more cut cathodes. The Soviet Union was expanding its nickel-cutting facilities in an effort to add value to Soviet nickel exports as well as to increase their marketability. Reportedly, an automated nickel-cutting line was commissioned at the Severonikel complex on the Kola Peninsula. At yearend, in an unusual move, the Soviets were reportedly offering to sell nickel or cupronickel ore. This could possibly be an indication of processing and production problems at Noril'sk, where reports of smelter problems were published in the Western press, with indications that an accident had occurred.

In an effort to modernize nickel production, the Soviet Union contracted with Finland's Outokumpu Oy for equipment for the Pechenga nickel concentrator on the Kola Peninsula. Outokumpu Oy would deliver ore grinding, flotation, and chemical sections, with delivery beginning in July 1988 and continuing to mid-1989.

Although it appeared at yearend 1986 that an agreement would be reached permitting U.S. importation of Soviet nickel, these negotiations reached an apparent impasse in 1987. The agreement was to end an embargo of Soviet nickel imposed in 1983, when the Soviet Union refused to certify that its shipments to the United States contained no Cuban nickel.

Rare Earths and Other Metals.—The Kirgiz mining and metallurgical complex was the country's largest producer of rare-earth elements. The complex produced output in the form of metals, alloys, phosphors, salts, and other compounds. The assortment of products had increased from 15 in 1970 to 117 in 1985. During the 1981-85 period, production at the Kirgiz complex increased by 33%. During the 1986-90 period, plans called for the Kirgiz complex to introduce ion-exchange technology, which would facilitate complex utilization of the ore. In addition, owing to the complete renovation of the Ak-Tyuzskiy beneficiation plant, production was to increase. The Lovozerskiy mining and beneficiation complex on the Kola Peninsula was one of the largest enterprises in the U.S.S.R. for the extraction and beneficiation of rare-metal ores. The complex consisted of two mining directorates, the Karnasart, commissioned in 1951, and the Umbozero, commissioned in 1984, and two beneficiation plants attached to these mining directorates, along with geological and auxiliary support organizations. During the 1986-90 period, production at the Lovozerskiy complex was planned to increase by 80%. During the first quarter of 1987, the Lovozerskiy complex was exceeding the plan. Also, increased production of columbium, selenium, thallium, and tellurium was reported at the Ust'-Kamenogorsk lead-zinc plant in Kazakhstan.

Rhenium.—The principal raw material from which rhenium was extracted was molybdenum concentrates produced from the ore of copper-molybdenum deposits. The Dzhezkazgan copper complex in Kazakhstan was a producer of rhenium. However, large rhenium losses occurred during beneficiation, and tailings from the dumps at Dzhezkazgan were considered another significant potential source of rhenium.

Silver.—The U.S.S.R.'s Ministry of Geology called for exploration to be conducted more rapidly at the Dukat silver deposit in

Magadan Oblast' in the Soviet Far East and the Bol'shoy Kanimansur silver deposit in Tadzhikistan in Soviet Central Asia. In 1987, Turkey, as part of an agreement to pay for Soviet natural gas imports, began exporting silver to the U.S.S.R.

Tin.—A new automated production line to extract tin from lean ore was commissioned at the Khingan tin complex in the Birobidzhan Autonomous Oblast' in the Soviet Far East. Output at Khingan was planned to double by the year 2000.

Titanium.—The U.S.S.R.'s titanium industry was started in the early 1950's to meet the needs of the aerospace industry. Owing to the scarcity of domestic sources of rutile, titania production was based on ilmenite concentrate with a 55% to 65% TiO_2 content, derived from ore from placer deposits. Future titania production would be based on domestic sources of ilmenite. A large increase in metal production was reported at the Berezniki titanium-magnesium plant in the Urals, where production reportedly increased 27% over that of 1986. This 1987 increase exceeded the entire production increase at Berezniki during the 1981-85 period when production increased 17%, and it was a dramatic increase in comparison with the reported 3.4% increase in 1986 in production at Berezniki.[32]

Tungsten.—Development of a tungsten complex reportedly began in Dzhezkazgan Oblast', Kazakhstan. Also, after yearend, it was reported that the first batch of tungsten concentrate was produced at a new beneficiation facility at the Maritime Kray complex in the Soviet Far East. Output from the Maritime Kray complex, reportedly, would significantly increase the national supply of tungsten.

Vanadium.—The Karatau phosphate deposit in Kazakhstan contains the country's second largest reserves of vanadium after the Kachkanar iron ore deposit in the Urals, but the vanadium reserves at Karatau were not considered of industrial quality owing to the difficulty in concentrating the vanadium in the phosphate ore. The Soviets were experimenting with the technology for obtaining vanadium as a byproduct of the production of ferrophosphorus. Based on the success of these experiments, preliminary work was being conducted for mining vanadium from the Karatau phosphorus basin. Recommendations for proceeding with this technology were based in part on its long-term successful application in the United States. However, it was still under consideration concerning whether to give final approval to proceed with industrial development using this technology.[33]

INDUSTRIAL MINERALS

Asbestos.—In what appeared to be the only evidence of glasnost in industrial mineral production statistics, asbestos production began to be reported in the monthly statistical summaries. However, this practice continued only through November with no yearly production total reported. Based on reported national production of 2.1 million tons of asbestos through November, which was 3% higher than for the comparable period in 1986, it was possible to estimate national asbestos production for 1987 at 2.3 million tons and for 1986 at 2.2 million tons.[34]

It is not, however, clear, if the reported statistics were for grades 1 through 7 or only grades 1 through 6. In another report in the Soviet Mining Journal for November 1987, it was reported that the U.S.S.R. produced about 2.4 million tons per year of all grades of asbestos,[35] and the U.S.S.R. provided data to the Asbestos Production Institute stating that 1987 production was 2,554,600 tons. To produce this amount, the U.S.S.R. mined about 250 million tons per year of ore and overburden, of which 50 million tons was processed at beneficiation plants and 200 million tons was sent to dumps. The average capacity of a Soviet asbestos beneficiation plant was 350,000 tons per year. The largest open pits exceeded 200 meters in depth and produced more than 60 million tons per year of ore.

There were five asbestos-producing complexes, of which the largest and oldest, the Uralasbest complex, produced about one-half of the country's output.[36] Plans for 1987 called for Uralasbest to produce 1.14 million tons of asbestos grades 1 to 6. The Uralasbest complex contained two mining directorates, three beneficiation plants, and a separately sited mining directorate for processing anthophyllite asbestos.[37]

In 1987, the Soviet Union signed a trade agreement with Cuba, the German Democratic Republic, and Romania to supply them with large consignments of asbestos in 1988.

Bromine and Iodine.—A considerable percentage of the country's bromine and iodine was produced in the Soviet Central Asian Republic of Turkmenistan at the Cheleken and Nebit Dag plants. Production problems in recent years hampered plan

fulfillment in Turkmenistan, and in 1987, the plan for iodine production, reportedly, was not fulfilled.[38] Problems associated with brine transport were not resolved, and the complaint was raised that no proposals had been presented for guaranteeing the stability of brine conduit pipes and joints against corrosive media.[39]

At the Shatlyk deposit in Turkmenistan, which produced natural gas, iodine and bromine reserves were discovered, which prompted the State Committee for Reserves (GKZ) to conduct a special investigation to evaluate the industrial potential of the underground waters. After studying the underground waters of the production horizons at Shatlyk, it was determined that there was a significantly high content of iodine, bromine, and other valuable components to raise the possibility of transforming the Shatlyk region into a large natural gas and chemical production complex.

Cement.—Despite the fact that the U.S.S.R. was one of the world's largest cement producers with almost double the production of the United States, the U.S.S.R. reported a shortage of cement, with claims being made of a national shortfall of 4.5 million tons of cement in 1987.[40] Cement consumption in the U.S.S.R. per unit of national income produced reportedly was 150% higher than in advanced industrial countries. In 1987, out of a total production of 137 million tons of cement, 21.4 million tons was produced by the dry processing method. One of the chief tasks of the cement industry was to raise the level of technology to world standards, which in the process would entail greatly increasing output of cement obtained by dry processing.

Diamond.—Practically all significant resources of diamonds are in Yakutia. The Yakut diamond production association, Yakutalmaz, was formed in 1956. In 1957, stripping began at the Mir open pit and the first beneficiation plant was commissioned. The upper part of the deposit was being developed by open pits, and it was planned to develop underground mines for the lower part. The Yakutalmaz association exploited some of the country's deepest open pits with depths exceeding 300 meters. Deep underground mining was also occurring at Yakutalmaz. At the Internatsional'nyy Mine at Yakutalmaz a shaft was sunk to a depth of 1,000 meters, with the final projected depth of the shaft planned at 1,070 meters. The system of management at the Yakutalmaz association was being restructured to allow greater management and financial autonomy to the enterprises. This, it was hoped, would enable Yakutalmaz to arrest the marked decrease in mine development.[41]

It was announced by the Angolan News Agency that the U.S.S.R. would aid in the development of Angolan diamond mines, where production problems had been occurring in recent years.

Fluorspar.—Fluorspar deposits in Tadzhikistan, some of which had been exploited since the 1930's, reportedly were practically depleted. The U.S.S.R. was dependent on imports for more than 50% of its fluorspar requirements. However, practically all imported fluorspar came from Mongolia, a close ally of the U.S.S.R. and member of the CMEA. Along with the program of increasing fluorspar production in Mongolia new exploitable domestic reserves of fluorspar reportedly were being explored in central Turkmenistan and in the Paimir Mountain Range.

Nitrogen.—The plan for the 1986-90 period called for a 6-million-ton increase in ammonia production. In the U.S.S.R., about 40 modern ammonia-producing facilities, with capacities exceeding 1,300 tons per day of ammonia produced more than one-half of the country's ammonia. Plans called for introducing technology to increase output to this level at more plants. In 1987, two Japanese firms, Toyo Engineering Corp. and Mitsubishi Corp., contracted to renovate a number of ammonia plants in the U.S.S.R. with the work to be partly paid for in ammonia deliveries. Plans for the 1986-90 period called for continuing installation of imported urea plants with a capacity of 330,000 tons per year, built in Czechoslovakia according to the design of the Netherlands Stamicarbon firm. Also, construction had begun in Czechoslovakia of urea units with a 400,000-ton-per-year capacity, which would be exported to the U.S.S.R. In foreign trade, over 50% of Soviet nitrogenous fertilizer exports went to CMEA member countries. The U.S.S.R. was the only CMEA country exporting nitrogenous fertilizer, and Soviet exports supplied 90% of CMEA's import requirements.[42]

Phosphate.—About 70% of phosphorus-containing fertilizer production was based on apatite ore from the Khibiny deposit on the Kola Peninsula and almost 30% from phosphorites from the Karatau region in Kazakhstan. The volume of production at the Khibiny deposit was stabilizing, and

increases in phosphorus-containing raw material were to come from the Karatau region and from opening new deposits. The ore from these future sources, however, was lower in phosphorus content, and it would be necessary to develop new forms of fertilizer production to utilize this lower grade ore.[43]

At the Khibiny complex it would require large investments in equipment as well as new development and construction to maintain the level of output, including hastening completion of the No. 3 apatite beneficiation plant. The apatite complex mined more than 60 million tons per year of crude ore to produce slightly more than 19 million tons of apatite concentrate. If the Soviets were to proceed to meet the planned goal of increasing production to 20 million tons per year at Khibiny by 1990, they would have to invest almost 1 billion rubles.[44]

Apatite concentrate was also produced at the Kovdor iron ore mining and beneficiation complex on the Kola Peninsula, where an apatite-baddeleyite beneficiation plant was commissioned in 1975 to process tailings from the wet magnetic separation process at the iron ore beneficiation plant. The specific characteristic of the Kovdor apatite concentrate, which has a low fluorine content and a high magnesium oxide content, predetermined its use in the production of nonfluorine-containing phosphate. A large percentage of the country's production of defluorinated phosphate feed was produced from apatite concentrate from Kovdor. At Kovdor, annual production of iron ore concentrate averaged more than 5.8 million tons, and of apatite concentrate about 600,000 tons of P_2O_5 content. During 1981-85, the Kovdor complex produced 5 million tons of apatite concentrate totaling 1.6 million tons of P_2O_5. However, mining conditions were worsening at Kovdor with the increasing depth of open pits, which averaged 120 meters in 1980, 175 meters in 1986, and were projected to be 225 meters by 1990.[45]

At the Karatau complex in Kazakhstan, where underground mining accounted for only 7% of ore extraction, it was planned to increase production from underground mines. In 1987, at Karatau the first stage of the Aksay underground mine was commissioned. The mine was expected to achieve its design capacity of 3 million tons per year of ore in 1991. Also at Karatau, the new Koksu open pit was commissioned. Plans for Karatau for 1986-90 called for increasing production; Karatau phosphates were slated to provide 20.1% of the country's supply in 1990 in comparison with 18.2% in 1985.

At the Chilisay phosphate mining complex under development in Kazakhstan, a phosphorus fertilizer plant with a capacity of 700,000 tons per year was commissioned. Shipments of finely ground phosphate for direct application began from the plant and were expected to reach 200,000 tons in 1987.

In Estonia, which has the third largest deposit of phosphates in the country following the Kola and Karatau Fields, planned development had been postponed at the Tools and Kabala deposits. The main obstacles to exploiting these deposits were environmental, with the possible environmental problems being the subject of much concern. Detailed geological and hydrological studies had been commissioned for both the Tools and Kabala areas, and these projects reportedly would not proceed until it was certain that the environment, and in particular, the local water resources, would not be affected by mining.[46]

In foreign trade, the majority of the country's phosphate exports was sent to CMEA countries according to reciprocal-trade agreements. These shipments satisfied 20% to 25% of the CMEA countries' import requirements for phosphate fertilizer. The U.S.S.R. was the only CMEA country that exported phosphate fertilizer. Also, the Soviet Union was participating in phosphate development in foreign countries. The Soviets signed an agreement with the Peruvian public sector phosphate mining firm Empresa Promotora de Bayovar S.A. to provide assistance in developing a mining and beneficiation complex in northern Peru with a 1.5-million-ton-per-year 30.5% P_2O_5 concentrate production capacity. All production was to be exported to the U.S.S.R. Production of phosphorus-containing fertilizer was based not only on domestic sources, but also on imported superphosphoric acid from the United States. Plans for the 1986-90 period called for the U.S.S.R. also to utilize phosphate from Morocco and Syria.

Potash.—Extraction and processing of potash occurred at the Uralkaliy association in the Urals, the Byeloruskaliy association in Byelorussia, and the Silvinit and Stebnik associations in the Ukraine. These associations operated 11 mines and 11 beneficiation plants with a total volume of ore extraction of about 70 million tons per year.

Between 1990 and the year 2000, it was expected that the volume of potash ore

mined would increase to between 85 million and 100 million tons per year with constantly worsening mining conditions owing to the increasing depth of mines and the accompanying increasingly hazardous conditions.

Production conditions in the potash mining industry were made more difficult by the loss in 1986 of the Berezniki No. 3 Mine in the Urals from flooding, which resulted in the 1986 potash production plan not being accomplished. However, the plan for the first half of 1987 reportedly was fulfilled through selective mining of potash seams at operating mines and transferring increased mine production from the Berezniki No. 4 mine to the Berezniki No. 3 beneficiation plant, which was still in operation.

The U.S.S.R. produced primarily potassium chloride with a 57% to 62% K_2O content. Approximately 80% of the potassium chloride was produced by flotation, and 20% was produced by dissolution-recrystallization. As of 1988, the U.S.S.R. planned to produce potassium fertilizer solely in the granulated and macrocrystalline form to reduce both transport losses and environmental pollution from fines. The U.S.S.R. was also faced with the task of increasing production of nonchlorine types of potassium fertilizers, particularly potassium sulfate.

In foreign trade, the U.S.S.R. shipped about 60% of its potash exports to CMEA countries. Within the CMEA, the U.S.S.R. and the German Democratic Republic were both major potash exporters, and intra-bloc trade provided 95% of CMEA's potash requirements.

Refractory Materials.—In the U.S.S.R., more than 10 types of raw materials were used in the production of refractory materials although clays, dolomite, dunite, kaolin, magnesite, quartz, and quartz sand accounted for over 90% of the mining and consumption of refractory raw materials. The majority of refractory raw materials deposits are in the western part of the country with the eastern part of the country accounting for only 3% to 6% of production. The Ukrainian S.S.R. was one of the major producing regions, accounting for 35% of the refractory clays, 45% of the limestone and dolomite, and all of the kaolin used by steel plants in the country. In the U.S.S.R., refractory raw materials mining was conducted by about 30 mining enterprises exploiting about 50 deposits, and almost 95% of the ore was extracted from open pits.

The most commonly used refractory raw material was clay. Twenty refractory clay deposits were being exploited, with the largest volume of extraction occurring in Donetsk Oblast' in the Ukraine and in Voronezh Oblast' in the R.S.F.S.R. Forty kaolin deposits were identified, with industrial reserves of about 1 billion tons, and 19 deposits were listed as being exploited in the early 1980's. The largest reserves of kaolin are located in the Ukraine and Uzbek Republics.

There were 42 known quartz deposits and two known quartz sand deposits, of which 16 of the quartz deposits and both quartz sand deposits contain raw material suitable for refractory production. Two quartz deposits in Sverdlovsk Oblast' in the Urals and in Zhitomir Oblast' in the Ukraine were under exploitation, as were the two quartz sand deposits in Donetsk Oblast' in the Ukraine. For the production of magnesium refractory materials, the only magnesite deposits under exploitation were in the Satkinskaya group of deposits in Chelyabinsk Oblast' in the Urals.

As of 1984 there were 44 known dolomite deposits with more than 3 billion tons of industrial reserves, mostly in the Urals and the Donetsko-Pridneprovskiy Economic Regions. As of 1983, 17 dolomite deposits were being exploited. For producing forsterite refractory materials, the Solovyevogorskoye dunite deposit in Sverdlovsk Oblast' was being exploited, with adequate long-term reserves.

The plan for 1986-90 and for the period to the year 2000 called for the introduction of advanced technological processes in steelmaking, which necessitated expanding the production of more durable and effective refractory materials. The production of highly effective refractories required a high-quality raw material supply, and raw material shortages were holding back the rapid development of the refractory materials industry.

Although the U.S.S.R. has large reserves of the basic refractory raw materials, the country was confronting a number of problems regarding its future supply. Numerous problems existed in securing the supply of magnesium refractory raw materials. To provide for its need for magnesite, the U.S.S.R. imported about 24% of its domestically consumed magnesite from North Korea. Shortages of kaolin existed in Soviet Central Asia, and kaolin had to be shipped there from the Ukraine. Reserves of refractory dolomite in the Donetsko-Pridne-

provskiy Economic Region were almost depleted, causing problems in supplying the southern metallurgical base.[47]

Sodium Compounds and Byproducts.—Turkmenistan accounted for more than 35% of the country's sodium sulfate production and all of the country's production of epsomite and medicinal Glauber's salt. Although in 1986 Turkmenistan fell far short of its planned target for sodium sulfate production and its Glauber's salt production significantly declined, sodium sulfate production in Turkmenistan reportedly increased 6% in 1987 to 261,000 tons.

Production in Turkmenistan occurred in the Kara-Bogaz-Gol, a vast lagoon off the east shore of the Caspian Sea containing one of the world's largest deposits of natural sodium sulfate. In 1980, because of concern for the declining water level of the Caspian Sea, a dam was constructed across the strait through which Caspian water entered the Kara-Bogaz-Gol. The cessation of water inflow from the Caspian Sea resulted in environmental damage to the lagoon not foreseen at the time that the dam was constructed, and it increased the difficulty in mining sodium sulfate and other salts. Efforts to increase water flow to the lagoon had not solved the problem. Soviet scientists predicted that unless adequate water reached the lagoon in the near future, than 80% of the valuable minerals in the lagoon would be irretrievably lost.[48]

Plans for Turkmenistan for the 1981-85 period—calling for commissioning plants for the production of bischofite, sodium sulfate, and epsomite—had to be postponed to the 1986-90 plan period. Also, because of the drying up of the lagoon, plans for a bromine plant had to be discarded.

The Karabogaz sulfate association in Turkmenistan was undergoing substantial renovation. New equipment was being installed in the sodium sulfate plant and the bischofite plant was being renovated. Bischofite production in Turkmenistan increased by 12% to 78,600 tons.

Outside Turkmenistan, plans called for significantly expanding production at two soda ash producing enterprises, the Slavyansk chemical industry association and the Crimea soda plant, both in the Ukraine.

Sulfur.—The U.S.S.R. released sulfur production statistics from natural gas for 1970-85 at 5-year intervals, showing that a major leap in sulfur production from natural gas occurred in the 1970's, but that during the first half of the 1980's there was no similar advance. Reported sulfur production from natural gas was as follows: 1970, 415,000 tons; 1975, 958,000 tons; 1980, 1.67 million tons; 1985, 1.97 million tons.[49] The large increase in production in the 1970's was the result of the commissioning of sour-gas-processing facilities at Orenburg in the Volga region and Mubarek in Soviet Central Asia, and the next major increase was to occur from the newly commissioned Astrakhan plant north of the Caspian Sea.

At the Astrakhan sour-gas complex, the first stage of which was commissioned in late 1986, plans called for producing about 5 million tons per year of sulfur when operating at full capacity. By November, Astrakhan had produced over 500,000 tons. Astrakhan was being developed in two stages of four trains each. The second stage at Astrakhan was scheduled to begin operations in 1989. Numerous problems, however, were impeding construction. Work stoppages owing to defective and improperly installed equipment, much of which was imported, were preventing the plant from working to capacity. Not only was Astrakhan troubled by losses from underexploitation of the field, but environmental pollution, which was far worse than envisioned, had reached a critical level.

In Turkmenistan, which contained the Gaurdak natural sulfur mining complex, sulfur production reportedly increased 11% in 1987 reaching 554,700 tons. At Gaurdak, the complaint was raised concerning poor recovery indicators for the Frasch process.

MINERAL FUELS

Coal.—Coal output increased for the second successive year, after a decade of declining production. The coal industry operated 509 underground mines, 76 separately administered open pits, and 162 washeries and briquetting plants. The Donbas was the largest coal-producing area with the largest amount of underground mining. The

Kuznetsk Basin (Kuzbas) was the second largest mining region, and about two-thirds of the coal from the Kuzbas was mined underground.

Table 9.—U.S.S.R.: Capacity of largest coal mines in 1987

Mine	Coal basin	Capacity (million tons per year)
Underground:		
Raspadskaya	Kuznetsk	7.5
Vorgashorskaya No. 1	Pechora	4.5
A. G. Stakhanov	Donets	4.0
50th Anniversary of the October Revolution.	Karaganda	4.0
Tentekskaya No. 8	do	4.0
60th Anniversary of the U.S.S.R.	Donets	3.0
Dolzhanskya Kapital'naya.	do	3.0
Open pit:		
Bogatyr'	Ekibastuz	52.0
Borodinskiy	Kansk-Achinsk.	27.5
Severnyy	Ekibastuz	22.0
Azeyskiy	Azey deposit, East Siberia.	15.0
Vostochnyy	Ekibastuz	15.0
Neryungrinskiy	Yakutsk	13.0

Source: Ugol' (Coal) (Moscow). No. 9, Sept. 1987.

During the period from 1980 to 1986, labor productivity in coal mining decreased considerably, with a 9.1% decrease in underground mining and a 4.6% decrease in open pit mining.[50] During the same period, coal production from open pits increased by 19.6% while production from underground mines decreased by 3.3%. Based on these figures, it was apparent that there was an increase in the labor force in coal mining. Apparently to reverse this trend, the Minister of the Coal Industry declared that planned automation of coal mines would reduce the work force by 23% by 1990.

Conditions in coal mines were becoming more difficult with the increasing depth of mines. More than 20% of the mines was deeper than 700 meters and 27 mines exceeded 1,000 meters. More than 80% of mines was classified as dangerous in terms of methane, 72% of the working seams was considered dangerous in terms of dust explosions, and 37% of the mines exprienced sudden rock bursts and gas blowouts.[51] Plans for the 1986-90 period called for increasing the amount of washed coal to 190 million tons per year by 1990, in comparison with 176 million tons per year in 1985. Production of this amount of washed coal required more than twice the amount of raw coal. To accomplish this, it was planned to increase capacity at existing washeries and to construct five new washeries. Plans for 1990 also called for producing 89.5 million tons per year of large and average sizes, and 8.2 million tons per year of briquets.

The majority of the country's underground mines had a capacity of more than 900,000 tons per year, and more than one-third of coal mined underground was extracted from mines with a capacity of more than 1.5 million tons per year. Open pit mines with an annual capacity of more than 10 million tons per year produced 44% of the country's open pit mined coal. During the 1986-90 period, plans called for commissioning 120 million tons of open pit capacity, with new open pit capacity accounting for 58% of this amount and renovation and reequipping of existing open pits accounting for the remaining 42%.

The Ekibastuz subbituminous coal basin was one of the major areas for expanding coal production during the 1986-90 period, although the ash content of Ekibastuz coal at times exceeded 50%. Ekibastuz was the third largest coal-producing basin in the country and produced over 25% of the country's open pit production. In 1987, Ekibastuz fulfilled its plan, producing more than 87.5 million tons of coal. In 1987, the third stage of the Vostochnyy open pit at Ekibastuz was commissioned. The third stage would increase Vostochnyy's capacity by 7.5 million tons per year to 22.5 million tons per year. In 1987, Vostochnyy produced 13 million tons. Plans for the Ekibastuz Basin called for renovating the Bogatyr' open pit, increasing its capacity from 52 to 70 million tons per year. Also the renovation of the Severnyy open pit would be continued, increasing its capacity from 22 to between 26 and 30 million tons per year. Further development of the Vostochnyy open pit would increase its capacity to 30 million tons per year, and development was to proceed of the Maykubenskiy deposit with a design capacity of 20 million tons per year.

The Donbas was one of the country's oldest coal-producing regions. Thirty-two percent of the mines in the Donbas had been in operation more than 45 years, and 17% was operating before the revolution. After a decade of declining production in the Donbas, the country's largest coal-producing basin, production increased in 1986 and again in 1987. The Donbas was one of the country's primary sources of high-quality coal, including coking coal and anthracite. Production was hampered by out-

moded technology unsuitable for conditions in the Donbas, which has thinner seams at greater depths.[52] The average depth of mines in the Donbas exceeded 600 meters, with some mines more than 1,000 meters deep.

In the Kuzbas, which produced about 20% of the country's coal and was a major producer of high-quality coal and coking coal, the underground mines, which produced almost two-thirds of the basin's output, were being depleted and were in need of renovation.[53] Efforts were under way to expand open pit mining in the Kuzbas through both renovation of existing open pits and development of new open pits, to produce a total of 64 million tons per year by 1990.

The Kansk-Achinsk lignite basin in Siberia covers approximately 60,000 square kilometers containing 24 known coal deposits, the largest of which are the Berezovskoye, Uryupskoye, Barandatskoye, Altayskoye, Itatskoye, and Achinskoye in the western part and the Borodinskoye and Abanskoye in the eastern part. As of January 1986, reserves suitable for open pit mining totaled 112,000 million tons with 81,400 million tons in categories A+B+C1 called explored reserves.

Very ambitious plans existed for developing the Kansk-Achinsk lignite basin. These called for production of coal to increase by over 500% by the year 2005 to 260 million tons per year. To achieve this would require completing development of the Berezovskiy No. 1 open pit with a capacity of 55 million tons per year, renovating the Nazarov open pit to produce 14 million tons per year and developing the following open pits: Borodin No. 2 with a capacity of 40 million tons per year, Uryup with a capacity of 53 million tons per year, Itatskiy No. 1 with a capacity of 60 million tons per year, and Itatskiy No. 2 with a capacity of 50 million tons per year. The first priority was commissioning the first stage of the Berezovskiy No. 1 open pit in 1988 with a capacity of 27 million tons per year. Also, during the 1986-90 period, it was planned to commence development of the Borodin No. 2 open pit.

Development at the Kansk-Achinsk Basin was hindered by the lack of laborers and consumers in the region and the difficulty of long-distance transport of the lignite. The quality of the coal was low, with a moisture content of up to 40% and a calorific value of 3,500 kilocalories per kilogram. Originally, plans for utilizing Kansk-Achinsk lignite called for constructing a series of large-scale powerplants of 6,400-megawatt capacity each linked to long-distance electric transmission lines. However, it appeared that owing to technological and environmental problems, the number of these powerplants would be reduced to two or three.

Pipelines were being considered as a means of transporting Kansk-Achinsk lignite, but the technology for such pipeline transmission over long distances in cold temperature had not been adequately tested, and construction of a pipeline system would require a large expenditure of resources. Some progress, however, was occurring on slurry pipeline technology. In 1987, work was proceeding on a 250-kilometer slurry pipeline to transport coal from the Inskraya colliery in the Kuzbas to the Novosibirsk powerplant. The slurry would be produced in a plant near the city of Belovo using Italy's Snamprogetti S.p.A.'s Reocarb process. The pipeline was being regarded as a prototype for coal transport over long distances. Also, plans were under way for developing technology for obtaining high calorific hard fuel, synthetic liquid fuel, and gaseous fuel from Kansk-Achinsk lignite.

The plan for the 1986-90 period for Kansk-Achinsk called for commissioning an experimental installation at the Berezovskiy No. 1 open pit to produce briquets, and construction of an installation to produce liquid fuel was under way. Also, at the Krasnoyarsk powerplant, it was planned to construct an installation to produce semicoke from Kansk-Achinsk lignite. However, construction of these installations was far behind schedule, with projections for the year 2010 showing a very small output from these technologies.[54] Difficulty at arriving at a solution for utilizing Kansk-Achinsk lignite was delaying development at Kansk-Achinsk.

Natural Gas.—Soviet natural gas production increased by 6%, continuing the rapid increase in production that had made the U.S.S.R. the world's largest producer of natural gas and made natural gas the country's leading energy fuel for consumption. Production at the country's main natural

gas production association in West Siberia, the Urengoigazdobycha production association, which administered the Urengoi and Yamburg Fields, reached record-high levels in excess of 35.3 billion cubic feet per day. Still, questions were raised in the Soviet press concerning whether the U.S.S.R. was pursuing a wasteful policy of expenditure of natural gas resources, especially in comparison with Western countries.[55] Plans for 1988 called for natural gas production to increase again by about 6% to 27 trillion cubic feet.

At the massive Urengoi deposit, which was developed in the early part of the 1980's, natural gas production exceeded the plan. The major part of the natural gas production increase planned for the 1986-90 period was to come from development of the Yamburg deposit, north of Urengoi, where production capacity was planned to increase from about 1.8 trillion cubic feet per year in 1987 to 7.8 trillion cubic feet per year in 1990.

Although natural gas production was planned to expand primarily by increasing capacity at the Yamburg Field, there would also be increasing production at the Karachaganak Field in Kazakhstan, the Sovetabad Field in Turkmenistan, and the Astrakhan gas-chemical complex north of the Caspian Sea.

It appeared that production increased at the Sovetabad Field as Turkmenistan reported exceeding its natural gas production plan by 78 billion cubic feet of natural gas; Sovetabad was one of major sources for increased natural gas production in Turkmenistan. Kazakhstan, where the Karachaganak Field is located, reported an 8% increase in natural gas production. At the Astrakhan gas-chemical complex, work was delayed in bringing the first stage up to production capacity for processing 106 billion cubic feet per year of sour gas; the first stage was commissioned in 1986.

Following development of the Yamburg deposit, future areas for developing natural gas production were planned to shift further north with the development of fields in the Yamal Peninsula. Areas for future development also included offshore fields in the North Sea, Barents Sea, Kara Sea, and Sea of Okhotsk. Although exploration in the Barents, North, and Kara Seas was being conducted, there were no near-term production prospects from these regions. However, in the Sea of Okhotsk near Sakhalin Island, near-term production was planned. Also, in 1987, a pipeline was laid to transport associated gas produced from Sakhalin Island to the mainland.

In the area of gas conservation, additional gas-processing facilities were required. In West Siberia, the country's major oil-producing region, 30% of associated gas was still being flared. At yearend, in West Siberia, the Krasnoleninskaya and Noyabr'sk gas-processing plants were commissioned, and similar plants were under construction.

The Soviets stopped publishing annual natural gas export and import data in their foreign trade annual yearbook in 1977. In 1986, the Soviets again began publishing this data in the national economic statistical yearbook Narodnoye Khozyaystvo S.S.S.R. and also proceeded to publish this information in more detail in their 1987 foreign trade statistical yearbook Vneshnaya Torgovlya S.S.S.R. It was reported that in 1986 the U.S.S.R. exported 2.8 trillion cubic feet of natural gas, which was an increase from the 1985 amount of 2.4 trillion cubic feet. In 1987, Soviet natural gas exports increased to almost 3 trillion cubic feet. Reported natural gas exports to both East and West Europe increased slightly in 1987.

Turkey began receiving Soviet natural gas in the summer and was expected to increase its imports from 2.4 billion cubic feet per year to between 177 billion and 212 billion cubic feet per year once new pipelines were in operation. Soviet plans to rapidly expand gas exports to Western Europe appeared to have been hampered by Norway's 1986 pact to supply natural gas to Belgium, France, the Federal Republic of Germany, and the Netherlands. Reports, however, were appearing in the Western press that the Soviets were planning to extend their gas pipeline in Finland to Western Europe, creating a base for further penetration of West European markets. Also, gas exports to Eastern Europe would increase when the Progress pipeline from the Yamburg deposit to Uzhgorod, scheduled for commissioning in 1988, was on-stream. At yearend, the Soviets signed a protocol with Afghanistan for further developing the Afghan natural gas industry.

Nuclear Power.—In pursuance of its nuclear power program, in December 1987, the U.S.S.R. commissioned the Khmelnitskiy nuclear powerplant in the Ukraine. It was built in conjunction with other CMEA member countries. The first power block with a capacity of 1 gigawatt was connected to the

power grid, and construction of blocks 2 and 3 was under way. Expansion of capacity also occurred at the Balakovo, Zaporozh'ye, and Ignalina nuclear powerplants. In December, the No. 3 reactor at Chernobyl' was restarted. The No. 1 and No. 2 reactors had been restarted in 1986, while the badly damaged No. 4 reactor was entombed. Sitings for nuclear powerplants aroused opposition in the U.S.S.R. The Soviets announced that owing to public pressure, plans had been abandoned for completion of the Krasnodar nuclear powerplant near the Black Sea, and that public protests were responsible for delaying development of nuclear powerplants in other parts of the country. Also, the Soviet Union announced that it would cease construction of graphite-core reactors similar to the one at Chernobyl'. Nevertheless, officials still stressed that there would be an expansion in nuclear power until the end of the century, but the rate of this expansion appeared to be under debate with the curtailment of a number of projects.

Table 10.—U.S.S.R.: Estimated primary energy balance in 1987

(Million metric tons of standard coal equivalent[1])

	Production	Exports	Imports	Apparent consumption
Coal (lignite, anthracite, bituminous, coke)	460	38	11	433
Electric[2] (hydropower and nuclear power)	73	6	--	67
Fuelwood	24	--	--	24
Natural and associated gas	840	97	2	745
Oil, crude and petroleum products	893	280	23	636
Oil shale	10	--	--	10
Peat	4	--	--	4
Total	2,304	421	36	1,919

[1]Standard coal equivalent calculated at 7,000 kilocalories per kilogram. Figures in table calculated based on conversion factors for energy and fuels derived from the Soviet annual statistical yearbook series Narodnoye Khozyaystvo S.S.S.R.
[2]Electricity exports and imports calculated on the basis of energy generated from all sources.

Oil Shale.—Oil shale in the U.S.S.R. was produced from three deposits, the Estonian and Leningrad in the Baltic Basin and the Kashpirskoye in the Volga Basin. Annual production was 30 million tons per year, equivalent to about 10 million tons of standard fuel calculated at 7,000 kilocalories per kilogram. The Baltic Basin deposits accounted for 98% of national output. The country still needed to establish a unified reliable set of criteria for establishing the commercial viability of oil shale deposits.[56] Over 200 oil shale deposits were identified in the U.S.S.R., but oil shale reserves in the U.S.S.R. were poorly studied. Of total reserves of 1,062,000 million tons, only 6,200 million tons of reserves were in the categories of explored reserves A+B+C1.

In the U.S.S.R., the main oil shale consumer was the electric power generating sector, consuming over 80% of production as unprocessed fuel at electric powerplants with the oil shale processing sector consuming the remaining amount. Of the approximately 50 products produced from oil shale processing, the main products produced were shale tar which provided a base for the production of high-quality fuel oil, illuminating gas, oil for impregnating timber, naphtha, benzene, coke for carbon electrodes, tanning agents, adhesives, lacquer-like coating materials, mastics, bitumen-like substances, rubber modifiers, plugging substances, and others. Plans for the 1986-90 period called for an over 15% increase in output from oil shale processing.

Oil shale production peaked in 1980 at 36 million tons, falling to about 30 million tons by 1986. Part of the decrease in oil shale production was attributed to the fact that the electric powerplants using oil shale began working at under their peak load as nuclear powerplants began supplying the power grid. This in turn led to a reduction in oil shale mining, and in 1987, the 11 oil shale mines and 4 open pits were working at only 80% capacity.[57]

Peat.—Despite the fact that production of peat for fuel increased in 1986 and was planned to increase in 1987, the plan for the 1986-90 period called for significantly reducing the use of peat as a fuel at electric powerplants and significantly increasing the preparation of agricultural peat. Actual reported 1987 production of peat for fuel use fell significantly, which was more in keeping with the 5-year plan's goal.

Peat reserves in the U.S.S.R. are estimated at about 200,000 million tons, of which the majority of reserves are in West Siberia, with large reserves also in the North West and Central Economic Regions, the Byelorussian S.S.R., and the Baltic area. Peat deposits with an area of less than 100

hectares were considered small and uneconomic to exploit unless there were particularly favourable transport conditions.

The U.S.S.R. produced about 5 million tons per year of peat briquets. Design capacities for individual peat briquet plants were between 30,000 and 240,000 tons per year. Peat briquet production primarily occurred in the Byelorussian Republic which produced about one-half of the country's peat briquets.

Petroleum.—The U.S.S.R. produced a record-high amount of petroleum and gas condensate, exceeding the peak production level achieved in 1983. This was also the second straight year of recorded petroleum increases, following 2 years of declining production. According to the Minister of the Oil Industry, the industry's success was attributable in part to restructuring. Inefficient production units were abolished. Reportedly, 70,000 workers in the oil-producing industry were laid off and 856,000 workers, equaling 90% of the industry's remaining workers, were given pay raises.[58] Labor productivity in the oil-producing sector increased in the first half of 1987 after having steadily decreased in the previous 6 years.

The Minister of the Oil Industry reported that the country had almost 128,000 active oil wells in January 1987 with the number of wells planned to increase to 174,000 by the end of 1990. During the 1986-90 period, plans called for beginning production at 222 new oilfields, 94 of which would be in West Siberia. In 1988, production was planned to increase slightly with plans calling for production to start at 38 new fields and for more than 15,000 wells to be drilled.

Up to 40% of refinery output consisted of mazout, which was used primarily as boiler fuel. Plans for the oil industry for the period 1986 to 2000 called for more effective utilization of oil by increasing refinery capacity for the production of motor fuels, lubricating oil, paraffins, and feedstock for the petrochemical and microbiological industries. The program to increase production of these refinery products was coupled with programs for increased oil conservation and for substituting the use of mazout with coal, natural gas, and oil shale.

The major area for oil production increases would remain West Siberia. By 1990, plans called for oil production in West Siberia to increase to 3.2 billion barrels in comparison with 2.7 billion barrels in 1985 with West Siberia producing 69% of the country's output in 1990 in comparison with 63% in 1985. The 1987 plan called for West Siberia to produce 3 billion barrels. Increased production in West Siberia would not only augment total oil production, but would compensate for decreases in other areas of the country including the Komi A.S.S.R., the North Caucusus, Volga region, and Urals.

Nevertheless, in West Siberia, it was now necessary to develop smaller fields dispersed over a wide area, increasing the expense of oil production. In 1986, it required a 31% increase in investment to produce a 3% increase in production, and for 1987, plans called for an 18% increase in investment for a 2% increase in production. Although increases in investment were not always reflected in increased production in the year that they were made, the magnitude of the increase in investment in comparison with the increase in production was still evident.

Other areas where oil production increases were planned included the Tengiz Oilfield with large reserves in the pre-Caspian depression where production was planned to reach to about 51 million barrels per year by 1990. In Tengiz, which is in a desert, climatic conditions are harsh, and the sour crude from the deposit has a particularly corrosive quality, which called for specialized equipment, much of which was being imported from the West. High reservoir temperature and pressure resulted in blow outs, with one fire at a well at Tengiz having lasted more than a year.

Under a new law permitting foreign firms to engage in business ventures in the U.S.S.R. in partnership with Soviet firms, the United States Occidental Petroleum along with Italy's Montedison S.p.A. and Enichem, and Japan's Marubeni Corp., declared their intent to engage in a joint venture to construct and operate a petrochemical plant to process raw material from the Tengiz deposit.

In the Azerbaidzhan Republic, where the majority of the country's offshore oil production occurred from wells in the Caspian Sea, the 1987 plan for oil production, reportedly, was exceeded. The plan called for oil production to increase from 96 million barrels in 1986 to 101 million barrels in 1987. By 1990, oil production was planned to increase to 107 million barrels.

In the summer, it was announced that the Soviet Union began oil production in the Barents Sea. The field lies in a portion of

the Barents Sea claimed by the U.S.S.R., for which there was no dispute with Norway over ownership. However, the start of production, in part, confirmed assumptions concerning oil resources in the Barents Sea, and made more urgent the resolution of the long standing dispute between Norway and the Soviet Union concerning the line of demarkation in the Barents Sea.

In the Komi A.S.S.R. in the European North where production levels were stagnant, increased production was reported in 1987. Also in October, first output was reported from the Khar'yaginskoye deposit in Arkhangel'skaya Oblast', which was subbordinate to the Komi Field administratively. By 1990, output from Khar'yaginskoye was projected to be 15 million barrels per year. In the Komi A.S.S.R., 10 oil deposits were being exploited with the largest being the Usinskoye, Vozeyskoye, and Tebyksoye, and plans called for developing three additional fields in the European North in Arkhangel'skaya Oblast'. Occidental Petroleum was considering participating in a joint-venture oilfield development project that would involve development at Khar'yaginskoye.

In 1977, the Soviets stopped publishing crude oil and petroleum products trade data in their annual foreign trade yearbook. But in 1986, the Soviets began publishing this data in their national economic statistical yearbook Narodnoye Khozyaystvo S.S.S.R. and also proceeded to publish this information in more detail in their 1987 foreign trade statistical yearbook Vneshnaya Torgovlya S.S.S.R. Soviet exports of crude oil increased to over 1 trillion barrels in comparison with 956 billion barrels in 1986 while exports of petroleum products increased to 59.153 million tons in comparison with 56.798 million tons in 1986. The U.S.S.R. also imported some oil and refinery products, mainly from the Middle East for reexport. The U.S.S.R. decreased imports of crude petroleum slightly to 103 million barrels in comparison with 107 million barrels in 1986 and slightly increased imports of petroleum products to 2.16 million tons in 1987 in comparison with 2.025 million tons in 1986. Iraq was the Soviet Union's major supplier followed by Libya and Algeria.

Iran and the Soviet Union concluded an agreement whereby the Soviet Union would process crude oil from Iran. In addition, the U.S.S.R. agreed to provide technical advice and equipment for Iranian oil and gas exploration in the Caspian Sea. Also, in the Middle East, the U.S.S.R. signed an agreement with Yemen (Aden) to develop some of their oilfields.

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[1]This publication is based on a review of sources published in the U.S.S.R.

[2]Foreign mineral specialist, Division of International Minerals.

[3]Council for Mutual Economic Assistance (CMEA) was founded in Jan. 1949. The founding members were Bulgaria, Czechoslovakia, Hungary, Poland, Romania, and the U.S.S.R. Albania joined in Feb. 1949, but ceased to take part in meetings in 1961. The German Democratic Republic was admitted in 1950, Mongolia in 1961, Cuba in 1972, and Vietnam in 1978. Yugoslavia obtained permanent observer status in 1965. Other countries now participating as observers are Afghanistan, Angola, Ethiopia, Laos, Mozambique, Nicaragua, and Yemen (Aden).

[4]Sotsialisticheskaya industriya (Socialist Industry) (Moscow). May 13, 1988, p. 2.

[5]Ekonomicheskaya gazeta (Economic Gazette) (Moscow). No. 7, Feb. 1987, p. 2.

[6]Pravda (Moscow). July 4, 1987, p. 1.

[7]Promyshlennoye stroitel'stvo (Industrial Construction) (Moscow). June 1987, pp. 2-4.

[8]Razvedka i okhrana nedr (Exploration and Conservation of Mineral Resources) (Moscow). No. 7, July 1987, p. 11.

[9]Sovetskiy shakhter (Soviet Miner) (Moscow). No. 11, Nov. 1987, p. 24.

[10]Gornyy zhurnal, izvestiya uchebnykh zavedeniy Ministerstva Vyshego i Srednego Spetsial'nogo Obrazovaniya S.S.S.R. (Mining Journal, Reports of the Educational Institutes of the U.S.S.R. Ministry of Higher and Secondary Specialized Education) (Moscow). No. 10, Oct. 1987, pp. 1-8.

[11]Tsvetnye metally (Nonferrous Metals) (Moscow). No. 7, July 1987, pp. 5-14.

[12]———. No. 10, Oct. 1987, p. 89.

[13]Ekonomicheskaya gazeta (Economic Gazette) (Moscow). No. 10, Mar. 1988, p. 8.

[14]Gornyy zhurnal (Mining Journal) (Moscow). No. 11, Nov. 1987, pp. 51-54.

[15]Pravda (Moscow). Nov. 24, 1987, p. 2.

[16]Gornyy zhurnal (Mining Journal) (Moscow). No. 1, Jan. 1988, pp. 3-10.

[17]Pages 104-107 of work cited in footnote 12.

[18]Gornyy zhurnal (Mining Journal) (Moscow). No. 3, Mar. 1987, p. 1.

[19]Pages 64-66 of work cited in footnote 12.

[20]Stal' (Steel) (Moscow). No. 10, Oct. 1986, pp. 17-27.

[21]Ekonomicheskaya gazeta (Economic Gazette) (Moscow). No. 23, June 1987, p. 17.

[22]Tsvetnye metally (Nonferrous Metals) (Moscow). No. 6, June 1987, pp. 53-66.

[23]Sotsialisticheskaya industriya (Socialist Industry) (Moscow). June 20, 1987, p. 2.

[24]Metal Bulletin (London). June 20, 1988, p. 13.

[25]Work cited in footnote 24.

[26]Sotsialisticheskaya industriya (Socialist Industry) (Moscow). May 13, 1987, pp. 2-5, and Oct. 11, 1987, p. 1.

[27]———. Nov. 17, 1987, p. 1.

[28]Work cited in footnote 27.

[29]Pravda Ukrainy (Ukrainian Pravda) (Kiev). Jan. 29, 1988, p. 3.

[30]Zarya vostoka, (Eastern Dawn) (Tbilisi). Feb. 4, 1988, p. 1.

[31]———. Jan. 22, 1988, p. 4.

[32]Tsvetnye metally (Nonferrous Metals) (Moscow). No. 4, Apr. 1988, p. 12.

[33]Kompleksnoye ispol'zovaniye mineral'nogo syr'ya (Complex Utilization of Minerals in Ore) (Alma-Ata). No. 11 (113), 1987, pp. 39-42.

[34]Ekonomicheskaya gazeta (Economic Gazette) (Moscow). No. 51, Dec. 1987, p. 13.

[35]Pages 17-22 of work cited in footnote 14.

[36]Pages 57-60 of work cited in footnote 14.

[37]Work cited in footnote 36.

[38]Turkmenskaya iskra (Turkmenistan Spark) (Ashkhabad). Jan. 31, 1988, p. 2.

[39]———. Dec. 23, 1986, p. 2.
[40]Izvestiya Akademii Nauk S.S.S.R., seriya ekonomicheskaya (Reports of the U.S.S.R. Academy of Sciences, Economic Series) (Moscow). No. 3, 5-6, May-June 1986, pp. 35-46.
[41]Pages 54-57 of work cited in footnote 14.
[42]Ekonomicheskoye sotrudnichestvo stran-chlenov SEV (Economic Cooperation of the Member Countries of the Council for Mutual Economic Assistance (CMEA) (Moscow). No. 4, Apr. 1987, pp. 38-44.
[43]Zhurnal vsesoyuznogo khimicheskogo obshchestva im. D.I. Mendeleyeva (Journal of the D.I. Mendeleev All-Union Chemical Society) (Moscow). No. 2, Mar.-Apr. 1987, pp. 124-131.
[44]Work cited in footnote 15.
[45]Gornyy zhurnal (Mining Journal) (Moscow). No. 7, July 1987, pp. 5-27.
[46]Sovetskaya Estoniya (Soviet Estonia) (Tallin). Apr. 23, 1987.
[47]Razvedka i okhrana nedr (Exploration and Conservation of Mineral Resources) (Moscow). No. 2, Feb. 1987, pp. 40-44.
Gornyy zhurnal (Mining Journal) (Moscow). No. 1, Jan. 1987, pp. 20-25.
[48]Turkmenskaya iskra (Turkmenistan Spark) (Ashkhabad). May 8, 1988.
[49]Work cited in footnote 43.
[50]Ugol' (Coal) (Moscow). No. 11, Nov. 1987, p. 16.
[51]Bezopasnost' truda v promyshlennosti (Safety of Labor in Industry) (Moscow). No. 8, Aug. 1987, p. 3.
[52]Sotsialisticheskaya industriya (Socialist Industry) (Moscow). Dec. 26, 1987, p. 2.
[53]Ugol' (Coal) (Moscow). No. 11, Nov. 1987, pp. 25-27.
[54]———. No. 9, Sept. 1987, pp. 17-20.
[55]Pravda (Moscow). Nov. 17, 1987, p. 2.
[56]Goryuchiye slantsy (Oil Shale) (Tallin). No. 44, 1987.
[57]Pages 321-327 of work cited in footnote 56.
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The Mineral Industry of the United Arab Emirates

By Michael D. Fenton[1]

The United Arab Emirates (UAE), a federation of seven small principalities, Abu Dhabi, Dubai, Sharjah, Ajman, Umm al-Qaiwain, Ras al-Khaimah, and Fujairah, was one of the world's wealthiest countries. It was the most prosperous of the Persian Gulf's oil-producing states with a per capita income of about $17,000 and with oil revenues providing about 85% of Government receipts. Proven crude oil reserves in the UAE exceeded 33 billion barrels. Natural gas reserves may be as much as 111 trillion cubic feet, which was the third largest reserve of gas in the world after those of Iran and Saudi Arabia. The main centers of industrialization were Abu Dhabi and Dubai, which contained most of the hydrocarbon deposits. The remaining emirates depended on Federal assistance and aid from Abu Dhabi for their economic development.

An almost complete dependence on hydrocarbon resources continued to subject the country to external economic influences beyond its control. Oil revenues fell by more than 40% in 1986, which caused a decline in the gross domestic product by perhaps as much as 21%, but the return to oil price stability since mid-1986, and through 1987, caused a recovery of oil revenues by at least 30%. During this sharp recession, the Government apparently sought to compensate for the loss of revenue by increasing oil production while disregarding the production quotas imposed by the Organization of Petroleum Exporting Countries (OPEC). The UAE's need for revenue coincided with the buying surge of late 1987 that was generated by anxiety over rising war-related tension in the Persian Gulf and precautionary stock rebuilding.

PRODUCTION AND TRADE

Abu Dhabi contained more than 90% of the known hydrocarbon deposits and was the largest producer in the UAE. The state-owned Abu Dhabi National Oil Co. (ADNOC) was developing its oilfields through equity-sharing arrangements with several major international oil companies. Liquefied natural gas was produced from its offshore fields at Das Island, while gas from onshore fields was gathered at Ruwais.

Members of OPEC cut 1987 oil production to adhere to quotas they adopted in an effort to raise and stabilize world oil prices and to secure OPEC's share of the oil market. OPEC production fell 8.3% to 16.7 million barrels per day (bbl/d) during the first half of 1987 compared with the same period in 1986. As a result, world oil production fell 2.2% during the first half of 1987. However, OPEC production exceeded its combined quota of 16.6 million bbl/d by almost 4 million bbl/d in September because of alleged overproduction by several OPEC members, including the UAE.[2]

As in 1986, the UAE apparently did not adhere to the OPEC oil production quota.[3] Output by Abu Dhabi alone was about 1.2 million bbl/d in January, compared with the total UAE quota of 902,000 bbl/d. In deference to OPEC's call for restraint to firm softening prices, Dubai and Sharjah kept output at capacity, together producing about 400,000 bbl/d, which was maintained throughout the year. Abu Dhabi claimed to have been honoring its commitment to produce no more than 682,000 bbl/d.[4] Never-

theless, OPEC-induced production restraint kept the average output of the UAE during the first half of 1987 at 1.25 million bbl/d, compared with the quota of 902,000 bbl/d.[5] Apparently, despite frequent official denials, strong demand and firm prices prompted a sharp production rise at midyear, and that lasted throughout most of the second half. Abu Dhabi increased output to 1.4 million bbl/d to take the UAE total to 1.8 million bbl/d. Output rose during the fourth quarter and may briefly have reached 2 million bbl/d in early September.[6] Production then declined to 1.6 million bbl/d by yearend when Abu Dhabi agreed to reduce its production. The reasons for the decline were the avoidance of the dangerous Persian Gulf loading terminals by Japan, the UAE's biggest customer, and an end to the surge in orders during the third quarter. Export earnings from oil for Abu Dhabi and Dubai were about $6 billion and $2 billion, respectively, in 1987.

The UAE was Japan's largest source of oil after Saudi Arabia and Indonesia, despite a decline in volume and value of exports during the year. The value of oil exports declined by 22% below 1986 levels during the first 9 months of 1987 to $3.8 billion. Also, some Japanese liquefied petroleum gas (LPG) buyers declined to take their full LPG entitlement, some failed to renew contracts, and others were expected to cancel their contracts because of expected expansion of Indonesian productive capacity in 1988.

The Dubai Aluminium Co. Ltd. (Dubal) produced a record high 154,832 tons of finished aluminum, more than 20,000 tons above rated capacity. In sales, extrusion billet was its largest single product at 86,063 tons. Dubal expected that billet forming capacity would increase to 125,000 tons per year by late-1988. In addition, sales of foundry alloys, 99.7% ingot, and high-purity ingot were 31,038 tons, 16,835 tons, and 13,827 tons, respectively. Sales totaling 155,026 were made to 22 countries, and the largest buyer was Japan, which took 46%, 70,802 tons, of production. The United States, Taiwan, and the Republic of Korea took 29,283 tons, 11,318 tons, and 10,833 tons, respectively, while the UAE kept 9,062 tons. First-time buyers were Finland, Indonesia, and Sri Lanka. The desalination plant supplied an average 24.14 million gallons per day to Dubai, more than one-quarter of the daily demand.

Production at Ruwais Fertilizer Industries Co. Ltd. (Fertil) was a record high 378,300 tons of ammonia and 529,600 tons of urea. Local demand was met, and the number of international customers was increased. China, the biggest buyer, took 265,000 tons.

Table 1.—United Arab Emirates: Production of mineral commodities[1]

Emirate[2] and commodity[3]	1983	1984	1985	1986[p]	1987[e]
ABU DHABI					
Cement, hydraulic thousand metric tons	800	800	800	800	[4]700
Gas, natural:					
Gross million cubic feet	338,000	385,600	405,880	[e]391,000	390,000
Marketed do.	NA	355,000	[e]373,000	359,900	360,000
Natural gas liquids thousand 42-gallon barrels	[r]35,900	34,100	33,300	[e]34,000	34,000
Nitrogen, N content of ammonia thousand metric tons	--	226	282	291	303
Petroleum:					
Crude thousand 42-gallong barrels	284,000	256,047	287,700	348,555	386,230
Refinery products:					
Liquefied petroleum gas do.	1,500	1,700	2,300	[e]2,300	2,300
Gasoline do.	7,700	8,500	8,700	[e]8,700	8,700
Kerosene do.	[e]5,300	9,000	10,400	[e]10,400	10,400
Distillate fuel oil do.	[r]13,000	[r]15,400	15,000	[e]15,000	15,000
Residual fuel oil do.	[r]700	[r]14,700	11,300	[e]11,300	11,300
Naphtha do.	[r]1,900	[r]4,200	5,400	[e]5,400	5,400
Total do.	[r]30,400	[r]53,500	53,100	[e]53,100	53,100
Sulfur:					
Byproduct from petroleum refining metric tons	15,000	15,000	[4]1,460	1,460	1,460
Byproduct from natural gas do.	--	35,000	104,000	90,000	90,000

See footnotes at end of table.

Table 1.—United Arab Emirates: Production of mineral commodities[1] —Continued

Emirate[2] and commodity[3]	1983	1984	1985	1986[p]	1987[e]
DUBAI					
Aluminum, primary ingot metric tons	151,170	155,333	153,186	154,838	[4]154,832
Cement, hydraulic thousand metric tons	350	800	800	800	[4]500
Gas, natural:[e]					
Gross million cubic feet	150,000	107,000	[4]185,500	200,300	200,300
Marketed do	120,000	43,400	[4]75,220	[4]81,220	81,200
Natural gas liquids:					
Propane thousand 42-gallon barrels	10,000	10,000	4,000	[e]4,300	4,300
Butane do	8,000	8,000	2,500	2,700	2,700
Natural gasoline do	9,000	9,000	2,555	2,800	2,800
Petroleum, crude do	121,830	116,400	128,200	127,400	[4]137,810
FUJAIRAH					
Cement, hydraulic thousand metric tons	520	550	550	500	[4]380
RAS AL-KHAIMAH					
Cement, hydraulic do	1,200	1,200	1,200	360	[4]890
Gas, natural: Marketed million cubic feet	--	NA	4,590	[e]4,600	4,600
Lime[e] thousand metric tons	45	45	45	45	45
Natural gas liquids thousand 42-gallon barrels	--	2,120	3,640	4,680	4,700
SHARJAH					
Cement, hydraulic[e] thousand metric tons	685	700	700	330	[4]280
Gas, natural:					
Gross[e] million cubic feet	40,000	152,000	219,000	219,000	219,000
Marketed do	13,800	18,793	23,700	23,700	[4]23,725
Petroleum, crude and condensate thousand 42-gallon barrels	13,800	18,793	23,400	23,700	[4]23,725

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

[1]Table includes data available through July 22, 1988.

[2]In addition to the emirates listed, Ajman and Umm al-Qaiwain report 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, sand and gravel, and stone presumably are produced, but output is not recorded quantitatively, and general information is inadequate to make reliable estimates of output levels.

[4]Reported figure.

COMMODITY REVIEW

METALS

Aluminum.—Planning continued by Umm al-Qaiwain Aluminium Co. (Umalco) to establish the 240,000-ton-per-year aluminum smelter in Umm al-Qaiwain. Design and preliminary costings were nearing completion by the technology consultant for the project, Aluminum Co. of America. The industrial complex was to include a 595-megawatt power station and a 25-million-gallon-per-day desalination plant. Surplus electricity and water would be sold to the local authorities.

Aluminum sales contracts were established for a period of 12 years after the start of production, which was scheduled for year-end 1989. The China National Metal and Minerals Import and Export Corp. and the Everbright Aluminium Co. of China agreed to take 78,000 tons per year each, while a joint venture between the Japanese company Furukawa Mining Co. Ltd. and Southwire Corp. of the United States agreed to buy 120,000 tons per year, and Austria Metal Co. would purchase 25,000 tons per year.

Although a guaranteed source of an estimated required 130 million cubic feet per day of gas required for power generation was not secured, the most likely source would be Sharjah's Sajaa Field, which had surplus capacity, or the offshore Mubarak Field. The Mubarak Field, which was not producing gas commercially, would require a heavy investment in cleaning and compression facilities. The offshore Bukha Field owned by Oman was another possible source of gas.

Copper.—After a decade of intensive exploration, drilling in 1986 and 1987 for copper in rock units that were correlative with copper-bearing units in nearby Oman appeared to have established that the copper potential of the country was low.

INDUSTRIAL MINERALS

Cement.—The duty charged by Oman on cement imports was more than doubled from 20% to 50% to the detriment of UAE producers who were trying to maintain sales in a shrinking market. The UAE's eight cement producers had an annual capacity of about 7.6 million tons, but annual production was only 2.8 to 3 million tons, less than 40% of capacity. Local demand was about 1.6 million tons, and sales to Oman were 10,000 tons per month according to a quota system.

Fertilizer Materials.—Construction of a $71 million, 165,000-ton-per-year phosphoric acid plant was to begin in late 1987 at Jebel Ali, Dubai, by Emirates Narmada Industries, a joint venture of India's Gujarat Narmada Valley Fertilisers Co. and the Cayman Islands-based investment company Mozak International. Rock phosphate for the plant was expected to be supplied by Jordan, Morocco, or Togo. Since agriculture contributed only 2% to the gross national product, and since the UAE was giving priority to livestock breeding and fishing, there were no immediate plans to develop any downstream fertilizer capacity at Jebel Ali. The total phosphoric acid output was to be sold to diammonium phosphate manufacturers in India for use as feedstock for fertilizers. The UAE had a significant logistical advantage, and significant savings were expected by India by avoiding the freighting of bulky phosphate rock to India. A new desalination plant would use energy from the associated sulfuric acid plant, and byproduct gypsum may be available for sale. The plant was to be built to use the Norsk Hydro hemidihydrate process for the production of phosphoric acid.

Strontium.—A high-quality celestite deposit near the 119-million-ton gypsum deposit at Al Ain was investigated by TerraHunt Geoscience Ltd. of the United Kingdom and was found to be suitable for marketing and use in the manufacture of color television tubes. A viable mining operation was indicated by a prefeasibility study.

MINERAL FUELS

Natural Gas.—Gulf Oil Ras al-Khaimah, the operator of Saleh Field, sold its 50.46% share in this offshore concession, and a new company, Ras al-Khaimah Offshore Petroleum, was established to operate the field. Six wells were producing about 74,000 cubic feet of gas per day and about 6,000 bbl/d of condensate for sale on international markets.

One year after commissioning in May 1986, the Sharjah Liquefaction Co.'s LPG plant at Al-Hamriyah was producing 7,000 bbl/d of propane, 5,000 bbl/d of butane, and more than 4,000 bbl/d of condensate from 400 million cubic feet of wet gas per day. The plant was designed to produce 13,000 bbl/d of LPG and 4,600 bbl/d of condensate from 440 million cubic feet of gas.

Two gas discoveries were made in the onshore Bab and Bu Hasa onshore concessions operated by Abu Dhabi Co. for Onshore Oil Operations (Adco). Gas was found in the Habshan 3 and Thamama Zones of the Bab Field, and the Arab A, C, and D reservoirs of the Bu Hasa Field. Estimated reserves were 3.3 trillion cubic feet of natural gas.

Petroleum.—*Exploration and Development.*—Australia's BHP Petroleum Ltd. was to start a seismic survey offshore Fujairah in mid-February, and was planning to spud an exploratory well in late 1988 in a concession offshore from Oman, which borders Fujairah.

International Petroleum Corp. of Canada obtained an onshore concession agreement to explore for oil in northern Ras al-Khaimah. The acreage is adjacent to two producing areas, the Margham Field and the Sajaa Field, which were producing a combined 70,000 bbl/d.

The first exploratory well drilled in Sharjah in 4 years was planned by Amoco Sharjah Oil Co. to be drilled in August, onshore, south of the South Juweiza well that was drilled in 1983.

The new offshore Satah Oilfield in Abu Dhabi, scheduled for commissioning in March with an initial production capacity of 12,000 bbl/d, was to have nine dual oil-producing wells, two gas-injector wells, one gas-producing well, and nine dumpflood-injector wells. Umm Addalkh Development Co. (UDECO), a joint-venture operating company owned by ADNOC and the Japanese Oil Development Co., planned to raise the initial production capacity of 12,000 to 17,000 bbl/d. This output, when combined with UDECO's other offshore field, Umm Addalkh, would then average about 28,000 to 30,000 bbl/d. Abu Dhabi Oil Co. announced plans at yearend to start production from the Umm al-Anbar offshore oilfield at a rate of 10,000 bbl/d. Reserves were about 40 million barrels.

Production.—Changing economic conditions required continuing reductions in op-

erations of Adco that began in 1985. Adco agreed to cut its 1987 budget by more than 37% compared with 1986 estimated actual spending. The 15 rigs working in early 1986 were reduced to 11 by yearend 1986, to 6 by mid-1987, and 4 during the latter half of the year.

Production capacity of 440,000 bbl/d at the Bu Hasa Oilfield was expected to rise to 500,000 bbl/d when a program was completed to improve the oil-gathering system. Associated gases at Bu Hasa were processed on-site to extract natural gas liquids, which were then pumped to Ruwais.

Production resumed at Abu Dhabi's Abu al-Bukhoush Oilfield at 30,000 bbl/d, one-half of capacity, after being damaged by war planes in November 1986.

British Petroleum Arabian started its 30,000-ton-per-year lubricants plant at Jebel Ali, Dubai, at a rate of 20,000 tons per year.

Petrochemicals.—Construction began in the United Kingdom on a $1.6 million, skid-mounted cryogenic purge-gas recovery plant for Fertil that would enhance ammonia production at its Abu Dhabi complex.

Fertil, which makes and exports liquid anhydrous ammonia and urea for fertilizers, borrowed $13 million for the construction of a urea storage plant and hydrogen extraction unit.

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[1]Physical scientist, Division of International Minerals.
[2]Oil and Gas Journal. Sept. 14, 1987, p. 21.
[3]Middle East Economic Digest. Feb. 21, 1987, p. 27.
[4]Work cited in footnote 3.
[5]Middle East Economic Digest. Dec. 19, 1987, p. 77.
[6]———. Special Report. Nov. 1987, p. 2.

The Mineral Industry of the United Kingdom

By Richard H. Singleton[1]

Production of primary steel increased significantly to a 9-year high as a result of capacity enlargement and engineering improvements in smelting, casting, and rolling systems. State-owned British Steel Corp. (BSC), by far the largest producer, became one of the most profitable steel producers in Europe, and the Government revealed at yearend its intention to legislate privatization of BSC during 1988.

Construction of a promising gold mine began in Northern Ireland. Gold exploration in Scotland gave preliminary indications of economic viability. Tin mining remained in descendancy as attempts were made to decrease costs in order to remain competitive in the world market. The capacity and efficiency of secondary lead smelting were each increased, mainly by new plant construction. Tin smelting capacity, based mainly on imported raw materials, increased.

The domestic construction boom boosted sales of cement and related mineral construction materials. The cement industry abandoned its pricing and marketing system after more than 50 years of mutual controls. The largest cement producer began rationalizing its production and marketing facilities to improve its competitive position. British firms continued to acquire U.S. cement and aggregates industries. Fluorspar mining increased in capacity in response to increased steel production. Production and import of gypsum were stimulated by increased wallboard demand. The last known reserve of rock salt was opened for mining in response to increased demand, mainly for road deicing.

Privatization of the British energy industries continued. Denationalization of the crude oil production industry, which began in 1977, was virtually completed by yearend 1987. Privatization of the natural gas production industry occurred in 1986. Privatization of both the coal and the electrical power industries appeared imminent. The future well-being of the coal industry appeared to be in jeopardy because of a threat of cheap coal imports. Meanwhile, the coal industry was attempting to place long-term steam coal contracts with the electrical power industry. Also, coal production costs were being decreased by significant improvements in productivity through automation and equipment engineering improvements as well as increased use of longwall mining and closures of antiquated and inefficient mines.

Rapid depletion of the Frigg Field in the North Sea, the United Kingdom's largest source of domestic natural gas, sparked controversy between industrial advocates of increased domestic production and certain groups that were promoting increased imports, primarily from Norway. Development of new North Sea gas and oil fields began after an 18-month moratorium caused by low crude oil prices, and to a lesser degree, low natural gas prices. North Sea petroleum exploration was more active than in 1986.

It may be estimated that the minerals industry accounted for approximately 7% of the British gross domestic product (GDP). An approximate breakdown by value of the $35 billion[2] minerals industry was fuels, 70%; metals, 20%; and industrial minerals, 10%. Crude oil accounted for nearly 50% of the value of mineral fuel production, and the balance was about equally divided between the coal and natural gas industries. Steel accounted for about 90% of the value of the metals industry, which was depend-

ent on imports for most of its raw material. Mining, valued at about $30 million, was a minor part of the metals industry. Of this, more than one-half was tin concentrate, followed by iron ore and zinc concentrate. The future of tin mining in the United Kingdom remained in jeopardy because of its high cost relative to tin mining in most other countries. About 75% of the value of industrial minerals was accounted for by the aggregates, cement, and clay industries.

The United Kingdom continued to prosper. Growth in real GDP approached 4%, the inflation rate was near 4%, and unemployment continued to decrease. The major problem remained the trade deficit, which was caused mainly by high consumer spending.

PRODUCTION AND TRADE

Production of secondary cadmium metal and strontium mineral concentrate increased significantly. Exports of crude oil and its refinery products decreased after peaking in 1986, while crude production decreased somewhat. Imports of natural gas from Norway decreased.

Table 1.—United Kingdom: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Alumina from imported bauxite ---- thousand tons	93	105	110	110	110
Metal:					
Primary	252,525	287,874	275,373	275,876	[2]294,382
Secondary	128,258	143,949	127,595	116,406	[2]116,744
Cadmium: Metal including secondary	340	390	370	379	[2]467
Copper:					
Ore and concentrate, Cu content	652	660	596	602	800
Metal, refined:					
Primary	67,545	69,458	63,851	68,368	[2]54,023
Secondary	76,821	67,376	61,575	63,206	[2]68,264
Total	144,366	136,834	125,426	125,574	[2]122,287
Iron and steel:					
Iron ore:					
Gross weight ---- thousand tons	384	379	274	289	[2]269
Iron content ---- do	81	82	60	61	60
Metal:					
Pig iron ---- do	9,477	9,487	10,381	9,686	[2]11,895
Ferroalloys, blast-furnace:					
Ferromanganese ---- do	83	75	77	100	100
Steel, crude ---- do	14,986	15,121	15,722	14,725	[2]17,164
Rolled products ---- do	12,442	12,634	12,818	11,594	[2]13,061
Lead:					
Mine output, Pb content	3,797	2,431	3,994	3,600	[2]3,600
Metal:					
Smelter:					
Bullion from imported concentrate	40,740	36,071	35,994	37,798	[2]34,377
Secondary (refined)[3]	185,288	191,252	179,064	172,537	[2]200,657
Total	226,028	227,323	215,058	210,335	[2]235,034
Refined:					
Primary[4]	136,908	147,122	148,133	156,093	[2]137,493
Secondary[3]	185,288	191,252	179,064	172,537	[2]200,657
Total	322,196	338,374	327,197	328,630	[2]338,150
Magnesium metal, secondary including alloys[e]	1,700	1,000	900	1,000	1,000
Nickel metal, refined	23,200	22,300	17,800	30,900	[2]29,500
Silver metal ---- thousand troy ounces	85	82	55	57	55
Tin:					
Mine output, Sn content	4,025	5,216	5,204	4,276	4,000
Metal:					
Primary	6,497	7,105	7,548	9,227	12,000
Secondary (refined)	6,870	6,743	7,265	5,676	4,600
Zinc:					
Ore and concentrate, Zn content	8,906	7,478	5,344	5,605	6,500
Metal, smelter	87,651	85,604	74,278	85,902	[2]81,400

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS					
Barite thousand tons	36	63	107	87	[2]90
Bromine	25,800	28,500	29,850	26,000	26,000
Cement, hydraulic thousand tons	13,396	13,481	13,339	13,413	14,000
Clays:					
Fire clay do	689	757	831	940	900
Fuller's earth[5] do	192	202	216	202	210
Kaolin (china clay) do	[r]2,486	[r]2,810	[r]2,870	2,913	3,000
Ball clay and pottery clay do	598	629	587	611	700
Other including clay shale do	22,385	17,817	18,909	17,565	18,000
Diatomite[e]	300	200	200	300	340
Feldspar (china stone)	5,300	5,900	5,900	7,300	6,000
Fluorspar, all grades[6] thousand tons	131	137	167	133	130
Gypsum and anhydrite do	2,967	3,138	3,189	3,416	3,500
Lime: Quicklime and hydrated lime[e] do	2,500	2,500	2,500	[r]2,600	2,800
Nitrogen: N content of ammonia do	1,720	1,836	1,767	1,388	[2]1,415
Potash, K_2O equivalent do	308	324	343	403	[2]435
Salt:					
Rock do	1,316	1,569	2,030	2,040	2,000
From brine do	1,394	1,423	1,552	1,510	1,500
In brine, sold or used as such do	3,601	4,134	3,563	3,305	3,300
Sand and gravel:					
Common sand and gravel do	107,096	105,990	107,727	112,043	[2]110,754
Industrial sand do	4,025	4,329	4,178	4,108	4,200
Sodium compounds: Sodium carbonate[e] do	1,300	1,000	1,000	1,000	1,000
Stone:					
Crushed:					
Calcite do	10	7	6	10	10
Chalk do	12,430	12,022	12,023	12,511	13,000
Chert and flint do	174	17	22	14	15
Dolomite do	14,983	14,228	14,953	15,851	16,000
Igneous rock do	36,873	36,825	38,437	40,769	40,000
Limestone do	79,002	79,239	80,621	110,173	110,000
Sandstone including ganister do	14,736	15,116	13,177	14,058	14,000
Slate, including fill do	463	121	124	[r e]200	200
Total	158,671	157,575	159,363	193,586	193,225
Dimension:					
Igneous do	41	55	67	[r e]100	100
Limestone do	274	225	[r e]175	127	125
Sandstone do	101	117	130	120	125
Slate do	31	36	34	[e]35	35
Strontium minerals	12,100	16,100	23,000	14,700	22,500
Sulfur, byproduct:					
Of metallurgy thousand tons	69	71	69	70	[2]64
Of spent oxides do	3	1	--	--	--
Of petroleum refinery do	55	75	80	105	110
Total do	127	147	149	175	174
Talc, soapstone, pyrophyllite do	16	19	20	12	12
Titania[7] do	195	206	219	230	225
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite do	2,016	1,217	2,142	1,985	2,000
Bituminous including slurries, fines, etc do	117,238	49,965	91,905	109,564	105,000
Lignite do	1	2	5	7	7
Total do	119,255	51,184	94,052	111,556	107,007
Coke:					
Metallurgical do	7,192	5,866	7,838	7,795	8,000
Breeze, all types do	1,182	988	1,285	[e]1,300	1,300
Fuel briquets, all grades do	1,784	1,067	1,763	1,003	1,000
Gas, natural:					
Marketable[8] billion cubic feet	1,367	1,361	1,517	1,594	1,590
Marketed[9] do	1,279	1,263	1,403	1,474	1,470
Natural gas liquids[10] thousand 42-gallon barrels	47,300	55,000	59,200	[e]67,000	67,000
Petroleum:					
Crude[11] million 42-gallon barrels	809	885	894	884	861
Refinery products:					
Naphtha thousand 42-gallon barrels	32,300	29,100	26,200	24,100	[2]18,300
Gasoline do	179,800	189,900	190,100	199,500	[2]210,800
Jet fuel do	37,000	41,900	41,200	45,500	[2]47,600

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Kerosene ____ thousand 42-gallon barrels	13,900	16,200	18,100	16,800	[2]17,800
Distillate fuel oil ____ do ____	154,400	158,200	159,300	164,500	[2]164,500
Residual fuel oil ____ do ____	86,300	83,700	82,500	80,100	[2]80,100
Lubricants ____ do ____	6,600	7,900	8,400	6,500	7,000
Bitumen ____ do ____	11,100	11,100	11,000	11,700	12,000
Other ____ do ____	24,600	26,700	23,800	22,700	24,000
Refinery fuel and losses ____ do ____	[r]53,600	53,400	49,700	49,200	50,000
Total ____ do ____	599,600	618,100	610,300	620,600	632,100

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Includes data available through July 8, 1988.
[2]Reported figure.
[3]Includes a small quantity of primar lead from domestic concentrate.
[4]Produced entirely from imported bullion and includes the lead content of alloys.
[5]Salable product.
[6]Proportions of grades not available; probably about two-thirds acid grade.
[7]Sales.
[8]Methane excluding gas flared or reinjected.
[9]Marketable methane excluding that used for drilling, production, and pumping operations.
[10]Includes ethane, propane, butane, and other condensates.
[11]Excludes gases and condensates.

Table 2.—United Kingdom: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals ____	(2)	14	--	Sweden 13.
Alkaline-earth metals ____	1	(2)	--	All to West Germany.
Aluminum:				
Ore and concentrate ____	1,413	576	--	Sweden 337; Republic of Korea 66; Saudi Arabia 55.
Oxides and hydroxides ____	45,124	46,732	974	Sweden 5,203; Norway 4,559; Portugal 4,101.
Ash and residue containing aluminum	1,702	1,301	--	West Germany 885; France 81; United Arab Emirates 80.
Metal including alloys:				
Scrap ____	90,805	89,885	273	West Germany 36,800; Italy 16,435; France 8,987.
Unwrought ____	129,123	116,751	852	West Germany 54,905; Belgium-Luxembourg 13,073; Netherlands 8,299.
Semimanufactures ____	115,767	134,739	11,657	West Germany 24,087; Ireland 18,840; France 13,556.
Antimony: Metal including alloys, all forms ____	27	98	1	Italy 59; Yugoslavia 17; Sweden 6.
Arsenic: Oxides and acids ____	3,934	3,216	1,353	New Zealand 926; Finland 303.
Beryllium:				
Oxides and hydroxides ____	10	4	--	West Germany 2; United Arab Emirates 1.
Metal including alloys, all forms ____	1	(2)	(2)	Mainly to Saudi Arabia.
Bismuth: Metal including alloys, all forms ____	72	73	--	West Germany 23; Italy 23; Israel 7.
Cadmium: Metal including alloys, all forms ____	94	85	11	West Germany 42; Israel 13.
Cesium and rubidium: Metal including alloys, all forms ____	(2)	--		
Chromium:				
Ore and concentrate ____	172	406	--	West Germany 333; Norway 47; France 23.
Oxides and hydroxides ____	17,473	17,188	2,324	France 3,763; Australia 1,352.
Metal including alloys, all forms ____	4,071	3,829	1,789	West Germany 389; Japan 385.

See footnotes at end of table.

Table 2.—United Kingdom: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Cobalt:				
Oxides and hydroxides	429	603	35	Belgium-Luxembourg 221; Netherlands 121; France 60.
Metal including alloys, all forms	754	711	63	Netherlands 130; West Germany 118; France 69.
Columbium and tantalum:				
Ore and concentrate	1	14	--	West Germany 9; Spain 5.
Metal including alloys, all forms:				
Columbium (niobium)	9	6	(2)	Libya 3; Canada 1; Switzerland 1.
Tantalum	20	10	3	West Germany 4; Italy 2.
Copper:				
Ore and concentrate	3,412	6,374	(2)	Finland 3,140; Sweden 3,139; France 52.
Matte and speiss including cement copper	20	(2)	--	All to Spain.
Oxides and hydroxides	407	464	20	Singapore 134; Netherlands 77; Finland 57.
Sulfate	2,092	1,487	--	Nigeria 760; Cuba 118; Finland 104.
Ash and residue containing copper	7,106	2,893	--	Spain 1,320; India 895; Belgium-Luxembourg 311.
Metal including alloys:				
Scrap	109,109	125,323	41	West Germany 48,119; Italy 30,730; Belgium-Luxembourg 25,066.
Unwrought	31,551	29,906	94	Italy 7,956; West Germany 7,799; Sweden 3,704.
Semimanufactures	119,784	114,649	3,405	Switzerland 17,177; Ireland 11,089; West Germany 8,266.
Germanium: Metal including alloys, all forms	4	5	(2)	West Germany 4.
Gold:				
Waste and sweepings value, thousands	$19,816	$5,336	$466	Switzerland $3,082; West Germany $1,001; Belgium-Luxembourg $575.
Metal including alloys, unwrought and partly wrought do.	$13,503	$120,373	$51	Hong Kong $9,526; Ireland $3,041; unspecified $93,422.
Hafnium: Metal including alloys, all forms	(2)	(2)	(2)	Mainly to Sweden.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	5,710	1,008	--	West Germany 380; Guinea 236; Netherlands 152.
Pyrite, roasted	25	--		
Metal:				
Scrap thousand tons	4,536	3,837	(2)	Spain 1,805; East Germany 213; India 185.
Pig iron, cast iron, related materials	82,544	64,897	360	Belgium-Luxembourg 17,564; West Germany 12,843; France 11,272.
Ferroalloys:				
Ferrochromium	2,421	525	5	West Germany 164; France 79; Netherlands 49.
Ferromanganese	17,556	12,750	--	Belgium-Luxembourg 10,573; West Germany 1,461; France 442.
Ferromolybdenum	4,274	5,172	117	Netherlands 1,587; West Germany 1,148; Belgium-Luxembourg 501.
Ferronickel	28	11	10	France 1.
Ferrosilicomanganese	127	147	--	Ireland 101; Belgium-Luxembourg 24; West Germany 20.
Ferrosilicon	2,016	1,073	237	Belgium-Luxembourg 192; France 118.
Silicon metal	1,572	3,223	19	Norway 2,053; Ireland 313; Guinea 119.
Unspecified	12,251	12,984	330	West Germany 1,705; France 685; unspecified 5,463.
Steel, primary forms thousand tons	944	1,313	168	West Germany 237; Greece 209; Italy 173.

See footnotes at end of table.

Table 2.—United Kingdom: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections thousand tons	1,731	1,831	299	West Germany 170; Hong Kong 85.
Universals, plates, sheets do	1,310	1,388	83	West Germany 177; India 86.
Hoop and strip do	148	136	8	France 16; West Germany 14; Ireland 12.
Rails and accessories do	146	126	3	France 24; Canada 13; Singapore 12.
Wire do	116	109	19	Turkey 8; France 7.
Tubes, pipes, fittings do	567	461	21	Sweden 43; Netherlands 42; West Germany 37.
Castings and forgings, rough do	48	41	7	France 7; Sweden 7.
Lead:				
Ore and concentrate	3,728	3,191	--	France 1,633; Italy 1,470; Portugal 24.
Oxides	6,611	6,940	3	Ireland 2,371; West Germany 1,308; France 731.
Ash and residue containing lead	4,539	2,590	--	West Germany 2,017; Belgium-Luxembourg 233; East Germany 191.
Metal including alloys:				
Scrap	30,800	14,781	--	West Germany 5,763; Ireland 4,642; Netherlands 1,893.
Unwrought	123,173	119,700	1,130	West Germany 50,989; France 17,154; Belgium-Luxembourg 16,991.
Semimanufactures	5,776	6,971	889	Netherlands 702; West Germany 582; Sweden 432.
Magnesium: Metal including alloys:				
Scrap	523	440	--	Italy 167; West Germany 152; Netherlands 58.
Unwrought	1,041	838	290	Canada 120; France 92.
Semimanufactures	780	641	50	Ireland 134; Iran 79.
Manganese:				
Ore and concentrate, metallurgical-grade	3,855	235	--	Nigeria 95; Ireland 54; Jamaica 38.
Oxides	1,754	1,083	1	Nigeria 648; Ireland 79; Norway 70.
Metal including alloys, all forms	487	265	(2)	Spain 83; Italy 50; Belgium-Luxembourg 32.
Mercury 76-pound flasks	2,001	551	29	Switzerland 145; Belgium-Luxembourg 116.
Molybdenum:				
Ore and concentrate	4,403	2,893	--	Netherlands 1,371; Spain 897; Japan 259.
Oxides and hydroxides	1,595	1,109	(2)	Austria 464; Japan 358; Netherlands 115.
Metal including alloys:				
Scrap	16	12	3	West Germany 5; Norway 2.
Unwrought	219	465	4	Netherlands 292; Belgium-Luxembourg 48; West Germany 42.
Semimanufactures	166	150	30	Netherlands 31; France 23.
Nickel:				
Ore and concentrate	40	--		
Matte and speiss	322	683	--	Sweden 361; Canada 189; Belgium-Luxembourg 66.
Oxides and hydroxides	130	79	--	Netherlands 24; West Germany 19; Belgium-Luxembourg 12.
Ash and residue containing nickel	7,597	9,563	--	Canada 8,676; Japan 197; Norway 189.
Metal including alloys:				
Scrap	5,409	4,628	496	Sweden 1,997; Canada 702.
Unwrought	10,585	17,450	200	Belgium-Luxembourg 4,054; Japan 3,893; West Germany 2,619.
Semimanufactures	10,251	9,556	725	Japan 1,996; West Germany 1,713; France 1,430.
Platinum-group metals:				
Waste and sweepings value, thousands	$4,539	$1,319	$77	West Germany $669; Belgium-Luxembourg $342; Switzerland $194.
Metals including alloys, unwrought and partly wrought thousand troy ounces	1,768	2,058	771	Switzerland 257; Netherlands 129.
Rare-earth metals including alloys, all forms	57	41	4	West Germany 15; Ireland 15.

See footnotes at end of table.

Table 2.—United Kingdom: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Rhenium: Metal including alloys, all forms	(2)	1	1	
Selenium, elemental	146	120	4	Spain 26; West Germany 16; Italy 12.
Silicon, high-purity	26	14	--	West Germany 11; Japan 3.
Silver:				
Ore and concentrate[3] value, thousands	$66	$5	$5	
Waste and sweepings do.	$24,840	$12,208	$48	France $4,383; West Germany $3,696; Republic of South Africa $1,474.
Metal including alloys, unwrought and partly wrought thousand troy ounces	18,101	64,527	3,151	Switzerland 21,638; China 17,426; West Germany 11,767.
Tellurium and arsenic, elemental	54	202	9	Finland 106; Netherlands 44; West Germany 15.
Tin:				
Ore and concentrate	2,640	5,085	1	Netherlands 4,974; France 54; West Germany 25.
Oxides	549	631	214	Spain 156; Netherlands 92.
Ash and residue containing tin	662	297	--	West Germany 249; Netherlands 33; Belgium-Luxembourg 10.
Metal including alloys:				
Scrap	456	689	--	West Germany 192; Netherlands 146; Ireland 75.
Unwrought	8,894	16,610	103	Netherlands 6,939; U.S.S.R. 4,952; West Germany 1,641.
Semimanufactures	711	863	8	Netherlands 225; Ireland 114; West Germany 90.
Titanium:				
Ore and concentrate	1,125	--		
Oxides	17,313	23,696	5,647	Chile 1,679; Netherlands 1,620.
Metal including alloys:				
Scrap	1,351	1,065	552	West Germany 228; Canada 88.
Unwrought	196	191	1	West Germany 59; France 42; Italy 26.
Semimanufactures	966	840	71	West Germany 208; France 120.
Tungsten:				
Ore and concentrate	184	155	--	Japan 76; Switzerland 54; Netherlands 25.
Oxides and hydroxides	109	5	--	All to Austria.
Ash and residue containing tungsten	114	21	--	Do.
Metal including alloys:				
Scrap	353	248	33	West Germany 103; Belgium-Luxembourg 56.
Unwrought	264	104	1	West Germany 42; Austria 16; France 11.
Semimanufactures	218	143	14	Italy 30; Netherlands 23.
Uranium and thorium: Metal including alloys, all forms:				
Uranium	--	1	(2)	Mainly to Iran.
Thorium	3	19	18	NA.
Vanadium:				
Oxides and hydroxides	80	28	--	France 19; India 3; Switzerland 1.
Metal including alloys:				
Scrap	8	3	--	West Germany 1; Norway 1.
Unwrought	1	2	1	West Germany 1.
Semimanufactures	3	10	--	West Germany 3; Ireland 2; Netherlands 2.
Zinc:				
Ore and concentrate	109	5,224	--	France 5,017; Australia 92; West Germany 44.
Oxides	10,961	5,663	92	Ireland 1,075; West Germany 798; France 564.
Blue powder	2,807	1,986	753	Singapore 291; Saudi Arabia 162.
Matte	116	70	--	West Germany 42; France 19; Ireland 9.
Ash and residue containing zinc	4,836	6,390	--	Sweden 4,230; West Germany 531; Taiwan 400.
Metal including alloys:				
Scrap	17,846	17,287	--	West Germany 7,497; France 1,798; Netherlands 1,508.
Unwrought	16,612	22,127	1,377	France 5,416; Belgium-Luxembourg 4,253; Greece 2,258.
Semimanufactures	5,093	5,229	69	France 1,821; Nigeria 454; Ireland 384.

See footnotes at end of table.

Table 2.—United Kingdom: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Zirconium:				
Ore and concentrate	491	315	37	Belgium-Luxembourg 69; Portugal 40; Netherlands 39.
Metal including alloys:				
Scrap	117	50	10	France 25; North Korea 6.
Unwrought	36	52	3	Belgium-Luxembourg 12; Canada 12; Sweden 9.
Semimanufactures	26	21	1	Bangladesh 3; Ireland 3; Sweden 3.
Other:				
Ores and concentrates	2	(2)	(2)	
Oxides and hydroxides	1,093	878	274	West Germany 217; Japan 130.
Ashes and residues	15,014	14,930	1,150	Belgium-Luxembourg 10,694; Sweden 982.
Base metals including alloys, all forms	7	16	8	Belgium-Luxembourg 3; France 3.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc value, thousands	$2,558	$1,832	$127	Netherlands $374; West Germany $348.
Artificial:				
Corundum	6,290	7,535	1,000	West Germany 2,356; Australia 1,352.
Silicon carbide	531	625	14	West Germany 368; Belgium-Luxembourg 80; Republic of South Africa 66.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$4,491	$4,043	$600	India $1,002; Japan $293.
Grinding and polishing wheels and stones	3,901	4,057	459	France 570; West Germany 566.
Asbestos, crude	307	430	--	Spain 105; Republic of Korea 99; Yugoslavia 61.
Barite and witherite	17,106	6,722	5	West Germany 1,732; Ireland 879; Norway 762.
Boron materials:				
Crude natural borates	198	1,598	--	Venezuela 1,000; France 462; West Germany 115.
Elemental	28	28	3	Qatar 8; Belgium-Luxembourg 5; Malaysia 5.
Bromine	1,971	2,307	--	West Germany 949; France 852; Belgium-Luxembourg 183.
Cement	113,535	107,490	235	Ireland 48,068; Nigeria 12,037; Egypt 7,579.
Chalk	35,630	44,178	793	Finland 8,022; Ireland 4,218; West Germany 3,942.
Clays, crude:				
Bentonite thousand tons	40	34	(2)	Sweden 10; France 4; West Germany 3.
Chamotte earth do	(2)	(2)	--	Mainly to West Germany.
Fuller's earth do	23	23	(2)	Sweden 7; West Germany 6; France 2.
Kaolin do	2,575	2,524	21	Finland 580; West Germany 421; Sweden 325.
Unspecified do	345	363	NA	NA.
Cryolite and chiolite	437	1	--	All to Ireland.
Diamond:				
Gem, not set or strung value, thousands	1,602,087	$2,388,524	$402,518	Belgium-Luxembourg $1,235,548; India $266,743.
Industrial stones do	$16,338	$19,258	$3,470	Ireland $3,883; Belgium-Luxembourg $3,006.
Diatomite and other infusorial earth	178	522	(2)	Denmark 269; Nigeria 78; Belgium-Luxembourg 40.
Feldspar, fluorspar, related materials:				
Feldspar	316	357	--	Greece 136; Ireland 94; Trinidad and Tobago 66.
Fluorspar	7,505	5,137	20	West Germany 1,196; Netherlands 964; Sweden 677.
Unspecified	704	691	--	Ireland 665; Belgium-Luxembourg 26.

See footnotes at end of table.

Table 2.—United Kingdom: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Fertilizer materials:				
Crude, n.e.s	2,540	2,922	43	Ireland 2,308; Saudi Arabia 146; Netherlands 44.
Manufactured:				
Ammonia	316,715	70,849	17	Denmark 21,907; Spain 16,539; Belgium-Luxembourg 13,061.
Nitrogenous value, thousands	$11,553	$9,329	$7	Belgium-Luxembourg $3,570; Ireland $3,236; Netherlands $794.
Phosphatic	1,240	613	(2)	Sudan 204; Belgium-Luxembourg 195; Ireland 134.
Potassic	79,678	95,829	544	Finland 32,926; Belgium-Luxembourg 21,444; Norway 18,650.
Unspecified and mixed	349,780	327,324	225	Ireland 244,734; Netherlands 18,659; France 13,621.
Graphite, natural	2,565	3,741	20	West Germany 990; France 955; Italy 352.
Gypsum and plaster	16,354	17,421	33	Ireland 7,320; Bahrain 1,978; Hong Kong 1,418.
Iodine	224	197	1	U.S.S.R. 50; Netherlands 40; France 32.
Kyanite and related materials	5,172	4,631	71	West Germany 2,582; Ireland 375; Italy 328.
Lime	30,379	26,034	--	France 5,756; Ivory Coast 5,513; Trinidad and Tobago 3,709.
Magnesium compounds:				
Magnesite, crude	155	105	NA	NA.
Oxides and hydroxides	92,601	82,611	NA	NA.
Other	1	--		
Mica:				
Crude including splittings and waste	3,088	3,137	10	West Germany 922; Netherlands 370; Belgium-Luxembourg 340.
Worked including agglomerated splittings	211	106	18	Ireland 27; Norway 12.
Nitrates, crude	382	223	--	France 50; Ireland 46; West Germany 44.
Phosphates, crude	607	3,406	--	West Germany 3,094; Ireland 142; Bangladesh 50.
Pigments, mineral: Natural, crude	1,158	663	125	Saudi Arabia 175; Kenya 93.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$75,288	$65,376	$19,183	Switzerland $30,809; Thailand $3,474.
Synthetic do	$515	$522	$214	Ireland $75; India $51.
Pyrite, unroasted	186	82	--	France 43; Portugal 29; Pakistan 4.
Salt and brine	402,946	368,716	63	Sweden 180,695; Norway 50,882; Ireland 46,990.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked thousand tons	10	5	(2)	West Germany 2; Ireland 2.
Worked do	7	6	1	France 1; Ireland 1.
Dolomite, chiefly refractory-grade do	31	42	(2)	Sweden 23; Indonesia 3; Norway 2.
Gravel and crushed rock do	1,334	1,495	169	France 681; Belgium-Luxembourg 342; Ireland 153.
Limestone other than dimension do	650	592	--	Belgium-Luxembourg 179; Norway 140; Denmark 95.
Quartz and quartzite	1	(2)	(2)	Mainly to Japan.
Sand other than metal-bearing do	51	44	(2)	Ireland 19; Sweden 16; Norway 2.
Sulfur:				
Elemental:				
Crude including native and by-product	1,927	1,584	--	Netherlands 1,033; Nigeria 87; Ireland 70.
Colloidal, precipitated, sublimed	127	601	13	Nigeria 301; Ireland 134; Republic of South Africa 45.
Dioxide	134	93	--	West Germany 53; Belgium-Luxembourg 22; Netherlands 10.
Sulfuric acid	77,431	92,340	12,968	Ireland 32,221; Belgium-Luxembourg 14,845; Spain 10,906.
Talc, steatite, soapstone, pyrophyllite	4,843	2,541	65	Ireland 821; Nigeria 452; Belgium-Luxembourg 138.
Vermiculite, perlite, chlorite	1,411	1,604	--	West Germany 654; Ireland 316; Sweden 288.

See footnotes at end of table.

Table 2.—United Kingdom: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Other:				
Crude	37,654	26,747	31	West Germany 11,194; Belgium-Luxembourg 1,831; Ireland 1,680.
Slag and dross, not metal-bearing	30,187	72,643	381	West Germany 52,337; Denmark 8,700; Sweden 2,623.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	8,111	7,716	--	France 3,941; Ireland 2,437; Spain 202.
Carbon:				
Carbon black	51,677	44,431	295	Ireland 8,980; France 4,861; Denmark 4,276.
Gas carbon	30	14	--	NA.
Coal:				
Anthracite thousand tons	214	352	--	France 238; Belgium-Luxembourg 51; Norway 23.
Bituminous do	2,345	2,396	--	Denmark 1,025; Ireland 481; France 187.
Briquets of anthracite and bituminous coal do	99	155	(2)	Norway 85; France 43; Venezuela 16.
Lignite including briquets do	2	1	--	Mainly to Singapore.
Coke and semicoke do	1,163	1,163	--	Norway 204; Belgium-Luxembourg 179; Finland 146.
Gas, natural: Gaseous million cubic feet	2,146	3,366	211	Netherlands 1,174; Belgium-Luxembourg 961; France 487.
Peat including briquets and litter	9,778	16,617	4	France 7,936; Sweden 3,092; Spain 2,026.
Petroleum:				
Crude thousand 42-gallon barrels	579,271	597,584	122,920	Netherlands 111,441; West Germany 83,585.
Refinery products:				
Liquefied petroleum gas do	32,817	38,188	7,582	Netherlands 11,018; France 6,624.
Gasoline do	42,611	41,115	2,676	Netherlands 14,080; West Germany 8,419; Ireland 4,641.
Mineral jelly and wax do	356	364	31	Netherlands 76; West Germany 45.
Kerosene and jet fuel do	7,260	7,641	94	Ireland 2,290; Netherlands 1,091; Denmark 836.
Distillate fuel oil do	38,611	47,165	1,405	West Germany 12,690; France 8,797; Netherlands 8,389.
Lubricants do	5,729	5,150	370	Netherlands 858; West Germany 796; Belgium-Luxembourg 523.
Residual fuel oil do	23,666	22,713	2,823	Sweden 4,023; Ireland 3,652; Netherlands 3,465.
Bitumen and other residues do	433	522	(2)	Ireland 296; Sweden 56; unspecified 111.
Bituminous mixtures do	179	205	1	France 44; Ireland 41; Singapore 16.
Petroleum coke do	2,671	2,670	17	Spain 483; France 342; Netherlands 328.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	3,320	2,268	--	West Germany 1,563; France 702; Netherlands 3.
Alkaline-earth metals	57	73	NA	NA.
Aluminum:				
Ore and concentrate	257,532	270,767	251	Ghana 124,304; Brazil 112,180; Norway 9,534.
Oxides and hydroxides	572,791	559,045	3,483	Ireland 253,429; Jamaica 199,274; Greece 24,000.
Ash and residue containing aluminum	186	539	--	West Germany 362; Ghana 87; Belgium-Luxembourg 48.
Metal including alloys:				
Scrap	4,819	7,811	167	Ireland 5,355; West Germay 737; France 452.
Unwrought	147,113	182,165	2,153	Norway 113,948; Netherlands 15,476; Iceland 12,749.
Semimanufactures	239,639	251,763	5,210	West Germany 80,716; France 38,247; Belgium-Luxembourg 35,512.
Antimony:				
Oxides	1,021	1,325	36	France 853; Belgium-Luxembourg 125; China 122.
Metal including alloys, all forms	560	454	(2)	China 322; U.S.S.R. 34; Japan 25.
Arsenic: Oxides and acids	5,804	4,354	5	Philippines 1,086; Republic of South Africa 1,077; France 1,036.
Beryllium:				
Oxides and hydroxides	8	11	10	West Germany 1.
Metal including alloys, all forms	9	1	1	
Bismuth: Metal including alloys, all forms	402	370	3	Australia 123; West Germany 45; Mexico 42.
Cadmium: Metal including alloys, all forms	878	1,086	(2)	Netherlands 283; Canada 268; Finland 160.
Cesium and rubidium: Metal including alloys, all forms	(2)	1	--	All from Netherlands.
Chromium:				
Ore and concentrate	137,675	138,573	NA	NA.
Oxides and hydroxides	600	712	NA	NA.
Metal including alloys, all forms	356	378	12	Japan 156; France 112; Netherlands 36.
Cobalt:				
Oxides and hydroxides	378	526	3	Canada 399; Belgium-Luxembourg 65; Netherlands 50.
Metal including alloys, all forms	1,683	2,433	137	Zaire 593; Netherlands 360; Finland 245.
Columbium and tantalum:				
Ore and concentrate	1	6	--	All from Nigeria.
Metal including alloys, all forms:				
Columbium (niobium)	25	17	2	West Germany 9; Switzerland 4; Netherlands 3.
Tantalum	37	42	17	West Germany 19; Austria 2.
Copper:				
Ore and concentrate	1,220	10	--	West Germany 9.
Matte and speiss including cement copper	25	--		
Oxides and hydroxides	1,616	1,794	107	Australia 627; West Germany 465; Norway 422.
Sulfate	2,347	8,111	220	Italy 1,088; Belgium-Luxembourg 639; France 156.
Ash and residue containing copper	47,794	63,831	3,091	Sweden 21,022; Republic of South Africa 20,521; Belgium-Luxembourg 10,000.
Metal including alloys:				
Scrap	13,329	10,539	3,990	Republic of South Africa 1,131; Ireland 973.
Unwrought	314,124	344,119	2,535	Peru 59,648; Chile 59,401; Canada 54,130.
Semimanufactures	98,123	103,106	1,358	West Germany 36,607; France 14,283; Italy 9,305.
Germanium: Metal including alloys, all forms	3	17	2	Belgium-Luxembourg; 10; France 4.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Gold:				
Waste and sweepings value, thousands	$37,904	$110,349	$16,653	United Arab Emirates $22,805; Jordan $12,247; unspecified $39,419.
Metal including alloys, unwrought and partly wrought thousand troy ounces	739	1,704	NA	NA.
Hafnium: Metal including alloys, all forms	5	5	5	
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	15,404	14,558	(2)	Canada 5,096; Australia 2,975; Brazil 2,421.
Pyrite, roasted do	250	249	--	Sweden 223; Norway 24; Spain 1.
Metal:				
Scrap	50,090	46,517	16,197	Ireland 10,516; Canada 7,652.
Pig iron, cast iron, related materials	117,583	133,421	166	Canada 32,808; Brazil 29,921; France 24,643.
Ferroalloys:				
Ferrochromium	77,467	94,767	NA	NA.
Ferromanganese	44,552	53,396	--	Norway 21,841; France 6,525; West Germany 2,714.
Ferromolybdenum	376	276	--	Austria 136; Belgium-Luxembourg 115; Netherlands 19.
Ferronickel	17,286	21,545	230	Greece 7,672; Indonesia 5,201; Dominican Republic 2,148.
Ferrosilicochromium	1,064	21	--	Republic of South Africa 18; Sweden 3.
Ferrosilicomanganese	28,972	27,821	--	Norway 13,604; Republic of South Africa 11,003; Czechoslovakia 1,652.
Ferrosilicon	82,775	65,641	NA	NA.
Silicon metal	32,914	37,476	1,053	France 16,826; Norway 9,109; Republic of South Africa 7,645.
Unspecified	11,789	12,551	227	Norway 5,772; France 2,216; Italy 873.
Steel, primary forms thousand tons	986	1,127	16	West Germany 450; Netherlands 150; Belgium-Luxembourg 105.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	796	889	2	West Germany 115; Spain 107; France 90.
Universals, plates, sheets do	1,504	1,594	4	West Germany 294; Belgium-Luxembourg 269; Netherlands 227.
Hoop and strip do	156	170	1	West Germany 73; France 24; Belgium-Luxembourg 20.
Rails and accessories do	4	12	(2)	Belgium-Luxembourg 6; Sweden 4; West Germany 1.
Wire do	59	60	(2)	Belgium-Luxembourg 20; France 13; West Germany 7.
Tubes, pipes, fittings do	355	387	3	Japan 89; West Germany 56; Netherlands 53.
Castings and forgings, rough do	26	24	1	West Germany 6; France 4; Netherlands 3.
Lead:				
Ore and concentrate	25,931	36,301	--	Australia 10,727; Spain 8,415; Belgium-Luxembourg 6,485
Oxides	1,555	1,175	4	Netherlands 545; West Germany 509; Austria 66.
Ash and residue containing lead	15,092	16,144	5,480	West Germany 3,905; Sweden 3,162.
Metal including alloys:				
Scrap	2,045	3,817	1,048	Denmark 660; Sweden 500.
Unwrought	185,275	183,032	47	Australia 154,426; Canada 20,950; Sweden 2,530.
Semimanufactures	8,892	12,115	8	Belgium-Luxembourg 5,457; Ireland 4,849; West Germany 602.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Magnesium: Metal including alloys:				
Scrap	786	1,205	10	Belgium-Luxembourg 921; Republic of South Africa 109; Netherlands 64.
Unwrought	6,159	5,853	500	Norway 2,340; Canada 1,402; Netherlands 1,351.
Semimanufactures	r968	863	150	Norway 251; Belgium-Luxembourg 129.
Manganese:				
Ore and concentrate, metallurgical-grade	r386,298	159,501	--	Brazil 82,793; Repubic of South Africa 28,187; Australia 6,728.
Oxides	4,705	5,463	211	Ireland 2,793; Belgium-Luxembourg 1,387; Norway 544.
Metal including alloys, all forms	3,639	4,916	298	Republic of South Africa 3,661; China 404; France 335.
Mercury 76-pound flasks	11,368	12,093	812	Spain 5,800; Netherlands 4,408.
Molybdenum:				
Ore and concentrate	19,575	19,917	10,611	Peru 2,225; Chile 1,866.
Oxides and hydroxides	140	237	--	Netherlands 119; West Germany 64; Belgium-Luxembourg 38.
Metal including alloys:				
Scrap	72	53	(2)	Austria 34; West Germany 13; France 4.
Unwrought	88	78	17	France 42; Austria 12.
Semimanufactures	182	144	54	Austria 47; France 15.
Nickel:				
Ore and concentrate	--	8	--	All from West Germany.
Matte and speiss	42,754	38,008	--	Canada 37,663; Norway 119; Netherlands 101.
Oxides and hydroxides	1,062	598	9	Australia 429; Netherlands 102; Canada 48.
Ash and residue containing nickel	1,501	424	9	Netherlands 145; France 76; Denmark 57.
Metal including alloys:				
Scrap	4,139	3,195	549	France 446; Canada 350.
Unwrought	16,165	16,081	307	Netherlands 4,022; Australia 3,765; Finland 1,816.
Semimanufactures	5,946	4,503	1,686	West Germany 1,777; France 250.
Platinum-group metals:				
Waste and sweepings value, thousands	$47,313	$71,052	$11,526	Canada $6,317; Finland $5,939.
Metals including alloys, unwrought and partly wrought do.	$90,527	$194,729	$29,363	Republic of South Africa $38,385; Switzerland $36,279.
Rare-earth metals including alloys, all forms	88	61	2	France 18; Austria 14; Brazil 11.
Rhenium: Metal including alloys, all forms	(2)	2	NA	NA.
Selenium, elemental	411	394	6	Canada 100; Belgium-Luxembourg 84; Japan 63.
Silicon, high-purity	35	29	(2)	West Germany 13; Japan 12; Netherlands 2.
Silver:				
Ore and concentrate[3] value, thousands	$217,777	$220,193	$1,248	Republic of South Africa $114,570; Canada $95,751; Sweden $4,343.
Waste and sweepings do.	$58,016	$28,359	$7,837	Denmark $4,294; Canada $2,745.
Metal including alloys, unwrought and partly wrought thousand troy ounces	41,668	42,375	2,894	East Germany 14,532; France 8,456; Czechoslovakia 7,395.
Tellurium and arsenic, elemental	156	149	7	Sweden 92; Belgium-Luxembourg 22; Japan 7.
Tin:				
Ore and concentrate	20,711	30,166	19	Chile 15,444; Bolivia 4,146; Canada 3,887.
Oxides	19	29	(2)	Italy 20; Republic of South Africa 4; Netherlands 3.
Ash and residue containing tin	14,832	8,176	2,346	West Germany 1,848; Belgium-Luxembourg 1,481.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Tin —Continued				
Metal including alloys:				
Scrap	567	302	40	West Germany 51; Italy 39.
Unwrought	7,349	7,691	158	Netherlands 2,107; Singapore 1,200; Chile 1,106.
Semimanufactures	630	1,672	8	Malaysia 633; Netherlands 467; West Germany 167.
Titanium:				
Ore and concentrate	366,871	373,654	1	Australia 208,646; Norway 98,328; Sierra-Leone 25,643.
Oxides	4,286	4,062	251	West Germany 1,876; Belgium-Luxembourg 583; Czechoslovakia 467.
Metal including alloys:				
Scrap	6,494	7,114	3,495	U.S.S.R. 2,177; France 443.
Unwrought	405	500	150	Japan 303; West Germany 24.
Semimanufactures	1,068	1,243	882	Japan 158; West Germany 82.
Tungsten:				
Ore and concentrate	627	549	--	Portugal 222; Netherlands 99; West Germany 85.
Oxides and hydroxides	140	--		
Ash and residue containing tungsten	301	133	88	Nigeria 17; Portugal 13.
Metal including alloys:				
Scrap	366	265	75	Austria 52; West Germany 38.
Unwrought	180	160	19	Republic of Korea 63; Austria 38; France 21.
Semimanufactures	77	134	40	West Germany 25; Spain 20.
Uranium and thorium: Metal including alloys, all forms:				
Uranium	--	1	1	
Thorium	(2)	--		
Vanadium:				
Ore and concentrate	--	1	1	
Oxides and hydroxides	260	373	(2)	China 181; Finland 162; Republic of South Africa 22.
Ash and residue containing vanadium	--	43	--	All from Netherlands.
Metal including alloys:				
Scrap	(2)	3	1	West Germany 2.
Unwrought	108	119	10	West Germany 109.
Semimanufactures	21	33	(2)	Finland 20; West Germany 13.
Zinc:				
Ore and concentrate	185,407	201,098	--	Australia 58,299; Canada 57,893; Peru 37,750.
Oxides	4,413	5,857	21	West Germany 1,620; Mexico 1,238; France 843.
Blue powder	2,340	1,237	60	West Germany 946; Norway 121.
Matte	122	24	--	All from Belgium-Luxembourg.
Ash and residue containing zinc	19,309	18,631	2,302	West Germany 7,969; Peru 3,600.
Metal including alloys:				
Scrap	997	2,651	201	France 1,046; Canada 660.
Unwrought	135,468	105,781	1	Netherlands 32,024; Canada 28,863; Finland 23,297.
Semimanufactures	3,963	2,999	10	West Germany 1,273; France 721; Belgium-Luxembourg 295.
Zirconium:				
Ore and concentrate	48,827	33,275	50	Australia 19,823; Republic of South Africa 13,043; West Germany 184.
Metal including alloys:				
Scrap	34	74	23	West Germany 22; Sweden 21.
Unwrought	14	70	9	Canada 54; West Germany 2.
Semimanufactures	57	35	27	Sweden 6; France 2.
Other:				
Ores and concentrates	53	34	1	Sweden 31; Nigeria 2.
Oxides and hydroxides	440	1,143	511	France 395; West Germany 131.
Ashes and residues	7,585	8,035	2,047	Brazil 2,217; Netherlands 916.
Base metals including alloys, all forms	26	20	1	Canada 4; France 4; China 3.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc value, thousands	$18,201	$19,810	NA	NA.
Artificial:				
Corundum	26,170	16,339	70	Canada 7,608; Netherlands 4,368; West Germany 2,945.
Silicon carbide	18,210	17,779	2	Norway 10,449; West Germany 4,175; Spain 1,460.
Grinding and polishing wheels and stones	6,029	6,042	190	Netherlands 1,208; Italy 1,017; West Germany 963.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Asbestos, crude	37,639	26,765	211	Canada 20,819; Republic of South Africa 3,588; Italy 1,255.
Barite and witherite	120,347	90,386	(2)	Ireland 30,834; Morocco 26,709; Netherlands 16,793.
Boron materials:				
Crude natural borates	62,854	68,194	--	Turkey 67,836; Netherlands 333; Sweden 23.
Elemental	3	1	(2)	NA.
Oxides and acids	4,198	4,731	55	France 3,681; Belgium-Luxembourg 567; Turkey 400.
Bromine	9,276	8,454	3,072	Israel 5,037; Iceland 196.
Cement	623,391	650,224	278	Ireland 135,007; Netherlands 113,473; Poland 106,730.
Chalk	4,594	7,727	(2)	Denmark 7,325; Turkey 189; West Germany 79.
Clays, crude:				
Bentonite	83,982	102,572	21,913	Spain 44,330; Cyprus 24,461.
Chamotte earth	40,524	26,371	1,860	France 19,170; Republic of South Africa 3,808.
Fuller's earth	2,013	1,430	1,136	West Germany 207; Spain 76.
Kaolin	4,201	4,678	2,196	Belgium-Luxembourg 981; Netherlands 978.
Unspecified	51,002	36,364	12,134	France 8,732; Spain 4,749.
Cryolite and chiolite	3,626	1,033	--	All from Denmark.
Diamond:				
Gem, not set or strung value, thousands	$1,744,409	$2,470,074	NA	NA.
Industrial stones do.	$29,507	$39,367	NA	NA.
Diatomite and other infusorial earth	23,915	26,413	3,256	Denmark 18,474; France 3,400.
Feldspar, fluorspar, related materials:				
Feldspar	55,879	59,377	4	Norway 22,797; Finland 21,573; Sweden 11,881.
Fluorspar	2,422	4,314	--	Mexico 4,235; France 68; West Germany 11.
Unspecified	70,443	79,158	--	NA.
Fertilizer materials:				
Crude, n.e.s	2,340	2,835	--	Ireland 2,346; Sweden 311; France 135.
Manufactured:				
Nitrogenous value, thousands	$84,492	$84,491	$7	Netherlands $33,495; Belgium-Luxembourg $11,320; Ireland $6,413.
Phosphatic	246,103	274,663	11,919	Netherlands 141,954; Belgium-Luxembourg 35,433; Tunisia 27,589.
Potassic	582,222	478,652	287	East Germany 198,805; West Germany 131,410; U.S.S.R. 45,407.
Unspecified and mixed	513,791	533,804	2,364	Netherlands 100,243; Belgium-Luxembourg 94,851; Sweden 65,526.
Graphite, natural	23,461	23,104	199	China 8,183; Madagascar 6,679; Sri Lanka 2,338.
Gypsum and plaster	109,225	86,171	344	Ireland 47,846; France 16,189; Sweden 7,004.
Iodine	1,323	1,546	6	Japan 1,096; Chile 353; Ireland 37.
Kyanite and related materials	49,453	44,639	8,727	Republic of South Africa 22,523; France 10,025.
Lime	5,576	7,289	--	Ireland 6,518; France 661; Netherlands 66.
Magnesium compounds:				
Magnesite, crude	14,860	9,241	21	Greece 4,755; Turkey 2,800; France 1,501.
Oxides and hydroxides	121,284	115,292	473	Spain 28,643; Greece 25,677; Ireland 17,767.
Other	17,620	18,564	--	West Germany 9,572; East Germany 8,904; Belgium-Luxembourg 68.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Mica:				
Crude including splittings and waste	15,854	20,015	23	China 14,337; France 2,097; Brazil 1,387.
Worked including agglomerated splittings	602	513	11	Belgium-Luxembourg 150; France 131; Switzerland 51.
Nitrates, crude	7,080	6,677	--	Chile 5,496; Belgium-Luxembourg 1,109.
Phosphates, crude thousand tons	1,160	936	--	Morocco 539; Senegal 250; Israel 57.
Pigments, mineral:				
Natural, crude	2,704	2,687	11	India 1,272; Cyprus 1,184; Republic of South Africa 101.
Iron oxides and hydroxides, processed	33,625	33,323	339	West Germany 27,236; Belgium-Luxembourg 1,791; Spain 1,041.
Potassium salts, crude	30,425	32,144	--	West Germany 18,334; East Germany 13,810.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$68,512	$70,482	NA	NA.
Synthetic do	$1,545	$1,953	$127	Switzerland $751; Belgium-Luxembourg $301; Thailand $255.
Pyrite, unroasted	15,909	700,110	NA	Mainly from Poland.
Salt and brine	333,572	358,514	2,276	Netherlands 92,735; Italy 84,477; East Germany 47,402.
Sodium compounds, n.e.s.: Carbonate, manufactured	166,313	185,565	35,808	Poland 22,675; Sweden 17,989.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	73,029	200,454	238	Sweden 98,866; Norway 36,736; Spain 35,210.
Worked	74,761	92,239	7	Italy 33,022; Portugal 23,231; Spain 18,994.
Dolomite, chiefly refractory-grade	141,160	168,168	37	Spain 111,909; Norway 35,670; Belgium-Luxembourg 6,590.
Gravel and crushed rock	931,892	859,569	16	France 284,572; Ireland 258,311; Netherlands 128,379.
Limestone other than dimension	705	2,155	(2)	Spain 1,950; France 179; Ireland 25.
Quartz and quartzite	10,906	9,204	535	Republic of South Africa 3,575; France 962; Ireland 850.
Sand other than metal-bearing	58,410	58,042	998	Belgium-Luxembourg 41,182; Netherlands 7,754; West Germany 3,136.
Sulfur:				
Elemental:				
Crude including native and by-product	805,254	684,569	NA	NA.
Colloidal, precipitated, sublimed	524	564	6	France 354; West Germany 137; Ireland 23.
Dioxide	2,871	1,198	(2)	Sweden 1,176; France 22.
Talc, steatite, soapstone, pyrophyllite	59,135	68,409	574	France 12,523; Norway 11,704; Belgium-Luxembourg 10,812.
Vermiculite, perlite, chlorite	134,018	138,363	7	Republic of South Africa 51,678; Italy 42,160; Greece 27,725.
Other:				
Crude	3,056	2,754	--	Switzerland 1,620; Sweden 678; Spain 258.
Slag and dross, not metal-bearing	612,744	534,417	2,156	Belgium-Luxembourg 232,726; France 204,749; Netherlands 41,744.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	13,372	9,339	1,261	Trinidad and Tobago 4,067; France 3,118.
Carbon:				
Carbon black	105,483	104,477	--	France 31,524; Norway 9,109; unspecified 37,398.
Gas carbon	1,338	1,483	128	East Germany 532; West Germany 231; France 229.
Coal:				
Anthracite thousand tons	1,207	595	12	West Germany 271; Republic of South Africa 95; Netherlands 91.
Bituminous do	11,525	9,959	2,605	Australia 2,800; Netherlands 2,163.
Briquets of anthracite and bituminous coal do	192	89	(2)	West Germany 58; Netherlands 18; France 7.
Lignite including briquets do	42	21	(2)	East Germany 11; West Germany 6; Netherlands 2.
Coke and semicoke do	374	213	3	East Germany 106; Belgium-Luxembourg 54; Republic of South Africa 20.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Gas, natural: Gaseous million cubic feet	541,548	497,340	2	Norway 496,807; France 338; Belgium-Luxembourg 185.
Peat including briquets and litter	218,881	235,203	165	Ireland 196,830; U.S.S.R. 28,161; Finland 4,478.
Petroleum:				
Crude thousand 42-gallon barrels	197,524	237,910	1,597	Norway 89,097; Saudi Arabia 28,427; Turkey 20,894.
Refinery products:				
Liquefied petroleum gas do	5,897	6,253	80	Norway 1,464; Algeria 1,178; Netherlands 756.
Gasoline do	28,610	50,297	1,232	Netherlands 12,475; U.S.S.R. 9,228; Algeria 6,515.
Mineral jelly and wax do	88	134	4	Netherlands 68; Republic of South Africa 21; West Germany 16.
Kerosene and jet fuel do	2,353	4,372	44	Netherlands 1,718; France 877; Spain 628.
Distillate fuel oil do	11,558	14,521	460	U.S.S.R. 4,774; Netherlands 3,772; Belgium-Luxembourg 1,407.
Lubricants do	10,205	12,920	1,149	Netherlands 4,908; France 1,057.
Residual fuel oil do	114,625	75,811	654	Netherlands 11,710; U.S.S.R. 9,454; Libya 9,085.
Bitumen and other residues do	1,249	428	(2)	France 229; Belgium-Luxembourg 161; Netherlands 24.
Bituminous mixtures do	38	29	3	France 13; Netherlands 4.
Petroleum coke do	2,145	3,141	541	Belgium-Luxembourg 1,385; Netherlands 1,054.

NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

COMMODITY REVIEW

METALS

Gold.—Ennex International PLC was granted permission in early spring to develop an adit through hard rock to gold-bearing quartz veins in its Curraghinalt Prospect in the Sperrin Mountains of Northern Ireland. A tunnel-boring machine, previously proven in the coal industry and equipped with a diamond-tipped cutting head, was employed because it was inadvisable to use explosives in Northern Ireland in view of political unrest there. The vein structure was found to be continuous and well developed over a 21-meter-drift length, and the excellent ore grade was confirmed. Completion of the 400-meter adit and of lateral drifting of 700 meters along the main veins to a maximum depth of 120 meters, and the subsequent submission of a plan to commission a mining operation were scheduled for completion in 1988. Mine startup in 1989 was contingent upon securing approval in 1988. A production rate of 30,000 troy ounces per year was expected, and estimated reserves were in excess of 300,000 ounces of gold. Further exploration in the Sperrin Mountains by Ennex led to discovery of an initially promising deposit 13 kilometers southwest of Curraghinalt.

Ennex continued delineation of its Connonish gold exploration property in Scotland north of Glasgow. Preliminary data suggested a viable gold and silver mine with about one-half of the gold reserve of Curraghinalt. Ennex was expected to seek permission in early 1988 to evaluate the property by tunneling and cross cutting. A number of other companies continued gold exploration in Northern Ireland and Scotland.

Iron and Steel.—Raw steel production increased significantly to a 9-year high. Private firms accounted for about 21% of this production and most, but not all, were in good financial condition. Most private output went to the domestic market. State-owned BSC held part ownership in several private firms including the largest, recently formed United Engineering Steels Ltd. BSC, the world's fourth largest producer of raw steel, was one of the most profitable steel producers in Europe. An expanding over-

seas market accounted for nearly one-half of its 1987 sales. However, growing imports of billets and bars, especially from Brazil, Czechoslovakia, and Turkey, were penetrating the domestic market.

Eurofer, the trade association of the European Economic Community (EEC) Commission's major integrated steel producers, was unsuccessful in attempts to execute a muchneeded rationalization of the Western European steel industry. At yearend, this problem was in the hands of the EEC and Eurofer member governments. The British steel industry expected that it would not be significantly affected by the rationalization, in view of its high efficiency, lack of subsidization, and good financial condition.

The Government of the United Kingdom decided by yearend to pass legislation to privatize BSC near yearend 1988. BSC expected that it would then be allowed to market its products more efficiently.

The upgrading and enlargement of steelmaking equipment, which began in 1985, was continued through 1987. The projects included construction of continuous casting facilities and systems to replace expensive furnace coke with granulated coal that was directly injected in the furnace. A continuous bloom casting system was commissioned at BSC's integrated Scunthorpe steelworks. Another continuous casting system was to be installed in BSC's Llanwern integrated steelworks during 1988, after which 80% of the company's billet casting would be continuous. Scunthorpe began more extensive use of coal in its blast furnaces in 1987 and a $2 million granular-coal-injection system was expected to be commissioned at Ravenscraig in early 1988. Four blast furnaces had been equipped for coal injection by yearend 1987. A minirelining of one of three blast furnaces at Ravenscraig was completed in the spring.

Lead.—H. J. Enthoven and Son Ltd., a wholly owned subsidiary of Billiton (UK) Ltd., in turn a subsidiary of the Royal Dutch/Shell Group, commissioned in December its new 60,000-ton-per-year secondary lead smelting-refining complex at Darley Dale in Derbyshire. The smelter employed two of the largest secondary lead rotary furnaces ever built. The new refinery kettles also were much larger than the old design. The $17 million project had been initiated in 1984 to replace the antiquated secondary lead complex at the same site. The old complex was to continue operating until the new one was tested in its full operational range. The new plant was designed to cut energy use and production costs and thereby allow Enthoven to remain the largest British producer of secondary lead. A significant energy saving was obtained by pumping molten lead from the smelter to the refinery. Major products were refined secondary metal and battery strip. A modern strip mill was included in the new plant.

Total production of refined secondary lead in the United Kingdom increased significantly. Demand for strip was up in France, the Federal Republic of Germany, and Italy, but not in the United Kingdom. Production of lead bullion and refined primary lead in the United Kingdom increased significantly.

Tin.—Carnon Consolidated Tin Mines Ltd. continued operations, with Government aid, of its two mines in Cornwall. Output of tin concentrate in the United Kingdom decreased for the second consecutive year. Operating costs continued to be reduced by selective mining of rich and easily accessible veins, postponement of long-term development projects, staff cutbacks, and a wage freeze. Significant mine and mill improvements were made, particularly at the South Crofty Mine, where refurbishment of the hoisting shaft more than doubled ore hoisting capacity. Enlargement of the entrance incline facilitated the movement of workers and equipment into and out of the mine. Carnon claimed a cost reduction of just less than $10,000 per ton of tin in concentrate and projected a further cost reduction to about $8,400 by 1990. Nevertheless, Carnon experienced a financially difficult year. World tin prices were kept low by low mining costs in several other countries, the weakening of the dollar, and a strengthening of the British pound. Turnover in the mines was reduced by 60% since the tin price crisis in the fall of 1985, to $27 million in 1987. World free market prices for tin metal during 1987 remained on average below $7,500 per ton of tin in concentrate.

Approximately one-half of Carnon's concentrate was sent to the Capper Pass metals reduction complex of the RTZ Corp. PLC (previously known as Rio Tinto Zinc Corp. PLC) for smelting, and the remainder was sold to or toll smelted by Billiton (UK) Ltd. The latter's throughput was down significantly because of a lack of feed material, partly because of an upgrading of tin concentrate in most world mines. Capper Pass depended on imports for most of its feed material, particularly from South America. Total output of primary tin in the United Kingdom increased significantly whereas that of secondary tin decreased. Carnon's byproduct copper and silver concentrates,

containing about 600 tons and 110,000 troy ounces of metal, respectively, was shipped to Boliden AB in Sweden. Its byproduct zinc concentrate, containing about 5,000 tons of metal, went to Commonwealth Smelting Ltd.'s smelter in Avonmouth.

Geevor Tin Mines PLC, the other British tin mining firm, discontinued tin mining after hoisting 40,000 tons of broken ore during the first half of the year at its Penzance Mine. Lifting the remaining 60,000 tons was held up pending a tin price recovery. Geevor processed older stocks into concentrate and shipped them to Capper Pass for toll smelting. Total sales decreased in value by nearly 75%, and the company began looking overseas for mining prospects.

Titanium.—Deeside Titanium Ltd., which had been operating at only about one-third of its 5,000-ton-per-year titanium sponge capacity, further lowered its production rate in the fall because of limited profitability and lowering world demand. Rolls Royce Ltd., owner of 82.5% of Deeside Titanium, had used most of the company's output over the previous few years, probably in the manufacture of its turbine engines. Deeside remained the United Kingdom's sole producer of titanium sponge.

INDUSTRIAL MINERALS

Aggregates.—ARC Ltd., the largest producer of aggregates in the United Kingdom and Europe's largest producer of marine aggregates, nearly completed a $40 million expansion of its Whatley limestone quarry to an annual capacity of 10 million tons of crushed stone, enabling it to meet anticipated demand increases in southern England. In another venture, ARC launched a second dredger in the Bristol Channel in April for production of marine aggregates. A third dredger was ordered for operation by July 1988. In May, ARC received an order for 1 million tons of marine aggregate for the foundations of the new Sizewell nuclear power station. Other major producers of British aggregates were Redland PLC and Tarmac PLC.

A large high-grade silica sand deposit covering 24 hectares and up to 90 meters deep was at Bogside, Fife. It was considered one of the country's largest deposits with a reserve of about 30 million tons. Fife Silica Sand Ltd. produced approximately 200,000 tons of industrial silica sand during 1987 on a leased portion of the site.

British firms continued to acquire U.S. aggregates operations. In March, ARC acquired American Aggregates Corp., a large producer of crushed limestone and sand and gravel in Ohio, Indiana, and Michigan, for $222 million. English China Clays PLC acquired J. L. Shiely Co., an aggregates firm based in Minnesota, for $73 million. Blue Circle Industries PLC increased its share of the U.S. aggregates industry by acquiring Raia Industries Inc., an aggregate and ready-mixed concrete producer in New Jersey, for $35 million.

Cement.—Aided by a construction boom, domestic cement sales increased despite continuing inroads by alternative materials, specifically ash and blast furnace slag and by imported cement. Less than 1% of production was exported.

A major concern of the domestic cement industry continued to be importation of low-priced and possibly subsidized cement. Although imports accounted for less than 5% of domestic consumption, about one-half of this amount, and a rising share, was from Greece and Eastern Europe, mainly the German Democratic Republic and Poland. The first shipload of subsidized cement from Greece, 5,000 tons, had arrived in June 1986. By yearend 1986, the EEC ordered the Greek Government to phase out subsidization of cement exports over a 3-year period. Meanwhile, a floating cement terminal had been installed for Grecian imports at Tilbury near London during 1986 and another was installed at Liverpool during 1987. Two Greek cement producers planned to ship up to 300,000 tons of cement per year to the United Kingdom. An agreement was reached by the British and Greek Governments not to exceed this figure, but its international legality was questionable in view of a provision of the Treaty of Rome. The British cement industry continued to allege that Greek cement was being dumped into the domestic market.

The Common Price and Marketing Arrangement (CPMA) was abandoned in February by the domestic producers after 53 years. The three major producers agreed that this action would enable them to better withstand competition in sensitive market areas such as those near cement ports of entry and those where competitive materials are produced.

Dissolution of this domestic cement cartel increased production and delivery flexibilities within the cement industry. Blue Circle, which accounted for more than 50% of British output, claimed a manufacturing and distribution cost saving of about $50

million in 1987. Modernization of Blue Circle's Cauldron and Dunbar cement plants, with a total annual capacity of about 1.75 million tons, had been completed in 1986 ending a 4-year modernization program of the company's plants. The company announced in January 1987 its intention to further rationalize more than one-half of its cement plants over a 2-year period and reduce its staff by 2,000. Annual capacity of its Northfleet plant in Kent was reduced by nearly 40% to 1.0 million tons. The plant utilized nearby chalk resources, which required use of the more energy-intensive wet process of cement manufacture. Total Blue Circle cement production capacity at year-end was about 8.5 million tons or approximately 55% of total British capacity.

RTZ Cement Ltd. started its dry-process kiln at its Ketton cement plant in Lincolnshire early in the year. The kiln, with an output of 950,000 tons per year, replaced six wet-process kilns. RTZ Cement claimed to be the country's lowest cost cement producer, accounting for 25% of total output. The third largest producer, Rugby Portland Cement PLC, operated six plants with a total annual capacity of 2.5 million tons. Rugby ended its domestic coal purchase contract, in favor of less costly imported coal. Two other small producers accounted for about 2% of British capacity.

Acquisition of U.S. cement producers by British firms continued. C. H. Beazer (Holdings) PLC had purchased Gifford Hill & Co., a large U.S. producer with five plants in the sunbelt, for $275 million in late 1986. Hanson Trust PLC, a conglomerate based in the United Kingdom, acquired Kaiser Cement Corp., another large producer with plants in California, for $250 million in March 1987. Parts of Kaiser were subsequently sold during the year by Hanson. Blue Circle remained the largest British owner of U.S. cement plants, and the U.S. sector accounted for 40% of the company's turnover in 1986. Profits in the U.S. sector were down, however, because of pricing competition, and this caused Blue Circle to give more attention to its cement industry in the United Kingdom.

Clays.—English China Clays, the United Kingdom's largest kaolin producer with about 90% of total output, opened a new kaolin mine, the Old Pound pit, in Cornwall. The operation, with a capacity of 90,000 tons per year and a reserve of more than 250,000 tons, was the first new china clay open pit operation to be developed in the United Kingdom for many years.

Laporte Industries Ltd. continued its search for bentonite deposits. It applied to open a new bentonite deposit near Redhill south of London. Additional fuller's earth reserves were developed by Laporte at Clophill in Bedfordshire.

Fluorspar.—In response to increased British steel production and chemical industry demand, the Deepwood Mining Co. Ltd., the country's largest fluorspar producer during the early 1980's, decided to reenter the fluorspar industry. High-grade ore from its three main open pits in Derbyshire was to be converted to acidspar assaying above 99% CaF_2 and free of arsenic and phosphorus. The planned acidspar production rate was 50,000 tons per year with byproduct concentrates of barite and lead. In addition, the company purchased what it considered to be the last large fluorspar ore body in the United Kingdom, also in Derbyshire. This, together with further exploration, was expected to create sufficient reserves to support an eventual annual acidspar output of 100,000 tons. The two other producers, Laporte, the largest, and Minworth Ltd., were each also increasing their fluorspar mining and beneficiation capacities. Establishment of a new mine in Derbyshire was begun by Laporte. External trade in fluorspar was minimal.

Gypsum.—British Gypsum Ltd., the sole producer of gypsum in the United Kingdom, gained access to its newly discovered 80-meter-deep deposit at Barrow-upon-Soar near Leicester in the fall by completion of twin 500-meter drifts. The new mine was to replace reserves that were nearing exhaustion.

The major domestic use for gypsum was in the manufacture of wallboard, although wallboard consumption per capita was three times less then that in the United States. BPB Industries PLC, British Gypsum's parent, had held a near monopoly in wallboard sales for 20 years. A joint venture between two large construction materials firms, Redland of the United Kingdom and CSR Ltd. of Australia, was formed in October for the purpose of entering the world wallboard market including the British market. Gypsum wallboard was to be imported from Norway until two plants were built in the United Kingdom. The plants were expected to be operational by 1991. One plant, on the River Avon near Bristol, was to have an annual capacity of about 25 million square meters of wallboard and would use gypsum imported from Spain.

Nitrogen.—Kemira Oy, the large Finnish

fertilizers and chemicals firm, began construction of a 200,000-ton-per-year ammonia plant in Hull on Humberside. The plant was scheduled for startup in 1988.

Salt.—In response to increased rock salt demand for road deicing, the Mond Div. of Imperial Chemical Industries PLC opened a 19-million-ton underground reserve, called the Whatcroft Development, in a new area north of its Meadowbrook underground mine at Winsford, Cheshire. Meadowbrook, the only other operating salt mine in the United Kingdom, produced about 2.0 million tons of 92% rock salt during 1987, a 10% increase over that of 1986. Cleveland Potash Ltd. was producing about 0.25 million tons of byproduct salt per year from its Boulby potash mine.

MINERAL FUELS

The British Government continued to declare its intention of privatizing its energy industry. It had begun its sale of British Petroleum Co. PLC (BP) shares in 1977 and essentially completed privatization of this largest British oil company by yearend 1987. In 1982, it had sold two of its smaller oil companies, British National Oil Corp. (which became Britoil PLC) and Enterprise Oil PLC. The British Gas Corp. (BGC) had been privatized in 1986. A think-tank group recommended to the Government in 1987 that British Coal Corp. be sold in 1988 but no action was taken by yearend 1987. The Government was planning to privatize the electrical power industry but no date was finalized.

Coal.—The future of British Coal, producer of 98% of the coal mined in the United Kingdom, was jeopardized by three domestic coal supply demand problems. The foremost problem was whether it could remain competitive in the face of low-cost imports. The Central Electricity Generating Board (CEGB), British Coal's largest customer, was considering the construction of sufficient terminals to import 30 million tons of coal per year. Existing terminals limited annual imports to about 10 million tons. The planned imports would seriously curtail British production and might eliminate the small Scottish coal mining industry. British Coal had a contract to deliver coal to CEGB at the rate of 72 million tons per year over a 5-year period beginning April 1, 1986, and the company was attempting to negotiate a 10-year contract. The 5-year contract price was based primarily on production costs and secondarily on imported and world market prices. CEGB about doubled its rate of coal imports near yearend after contracting to import 3.6 million tons over a 3-year period at a price of $35 per ton. The world market price, based on the U.S. dollar, had nearly halved in sterling since yearend 1985. The price of imported coal at yearend was nearly one-half that of domestic coal. Australian coal was significantly cheaper than U.S. coal, f.o.b. British ports. The import problem was exacerbated by the newly reelected Conservative Government's plans to privatize the electrical power industry and to subsequently loosen coal import regulations. The second problem facing the coal industry was the resistance of the largest coal mining union, the National Union of Mineworkers, to the adoption of flexible working hours. British Coal considered the change essential for further raising productivity, which reached a record 4.1 tons per workshift at yearend, a 60% rise since the end of the coal strike in March 1985. The third problem was the resistance of local officials and the public, for environmental reasons, to the development of new surface mines. Approximately 13% of domestic coal was produced by less costly surface mining.

During the fourth quarter, three more longwall mines, Stillingfleet, Whitemoor, and Ricall, in order of size, went on-stream within the large Selby complex under development in North Yorkshire. Total annual capacity of these mines approximated 4 million tons. A 500,000-ton-per-year open pit with a 6-year reserve was started at High Lane in Staffordshire. Expansions at four underground mines in other coalfields represented a potential 2.5-million-ton-per-year increase in output. The largest of these was the Maltby Parkgate Mine in South Yorkshire, where an 8-meter-diameter 4-skip shaft was sunk to gain access to an additional 40 million tons of coal. It would more than double the mine's annual coal production to 2.35 million tons by 1994. The other mines being expanded were Betteshanger, the only mine remaining in Kent; the Point of Ayr Mine on the coast of Clwyd in North Wales, where a new conveyor decline was commissioned in November to mine reserves under the sea; and the Cynheidre Mine in South Wales, where a 7-million-ton reserve of anthracite, being accessed through a drift, would be extracted at a rate of 500,000 tons per year beginning in 1988. A $700 million mining complex was under development at Ashfordby in the

Belvoir Valley in Leicestershire. The complex was to supply about 3 million tons per year to nearby power stations by 1994, replacing the output of exhausted mines nearby. The Government authorized construction of the Margam sloping drift mine in South Wales at a projected cost of $125 million. The mine would supply 1.2 million tons of coking coal per year to nearby steelworks at Llanwern and Port Talbot and reduce imports of coking coal. Actual construction was contingent upon an agreement between British Coal and the local labor union over flexible working hours, mainly a 6-day week. Plans were submitted for Government approval to construct a $700 million, deep, 1,200-meter mine called the Hawkhurst Moor project in the South Warwickshire coalfield in the Midlands. Twin 8-meter-diameter shafts were to be sunk to gain access to seven seams containing a 145-million-ton reserve. After 10 years of development with longwall technology, the mine was expected to employ 1,800 and produce 4 million tons per year of high-quality coal. British Coal closed seven inefficient collieries with a combined total annual capacity of 3 to 4 million tons. These included Ireland, Newstead, and Woolley, and four smaller mines, Abernant, Lady Windsor, Snowdon, and Whittle.

CEGB made formal application to the Government near yearend to construct an $800 million facility to reduce SO_2 emissions from its 4,000-megawatt Drax coal-fired power station in North Yorkshire. This largest such unit in Europe burned 11 million tons of coal per year. The desulfurization unit would be the United Kingdom's first and would require 700,000 tons per year of limestone. CEGB also planned similar units on each of its to-be-built 1,800-megawatt powerplants sited in West Burton in the Midlands and Fawley near the port of Southhampton. The latter station would burn imported coal or coal from the Nottinghamshire coalfield. Formal application had been made for construction of the two plants, and they were scheduled to go on-stream in the mid-1990's to replace other aging plants.

Imports accounted for nearly one-quarter of anthracite consumption. Imports from China of this high-demand material began in the fall at a contracted rate of 100,000 tons per year. Four mines in Wales accounted for about one-half of British production, much of it from deep inefficient mines. Only 5 of 13 coal mines in South Wales were profitable. Seam irregularities prevented use of longwall technology.

BSC consumed about 8.5 million tons of coking coal, of which about 30% was imported, mostly from the United States. Four blast furnaces were equipped to replace 30% of the coke charge with injected coal.

Natural Gas.—New gas discoveries in the British North Sea more than offset 1987 production, causing a 5% increase in proven reserves to about 45 trillion cubic feet. The Frigg Field, which supplied about one-third of domestic gas consumption, was depleting more rapidly than previously expected and was projected to be practically exhausted by 1990. Production from the West Sole Field in the southern basin decreased during 1987. A controversy arose regarding a future need to import large amounts of natural gas from Norway. The domestic petroleum industry argued that tax breaks would stimulate development of new fields in the North Sea.

Development of the V-Fields project and the Villages Complex in the southern basin of the North Sea continued on schedule and initial gas production from each was expected by yearend 1988. A fourth field, North Valiant, was added by the operator, Conoco (UK) Ltd., in 1987 to the three fields within the V-Fields project. Phillips Petroleum Co. (UK) Ltd. obtained Government approval to develop the large Audrey Field, also in the southern basin, which was expected to peak at 1,200 million cubic feet per day. Amoco (UK) Exploration Co. made Government application to further develop and increase reserves in two of its producing gasfields in the southern basin, East Leman and Indefatigable, at an estimated cost of about $140 million.

The second-phase development of the producing Morecambe Bay Gasfield in the Irish Sea continued and its scheduled completion by yearend 1988 was expected to double output to 1,200 million cubic feet per day. Development of the North Brae recycling gas-condensate field in the central North Sea was ahead of schedule, and condensate production was expected to begin by May 1988.

Several competing oil firms sought permits to build a gas-and-condensate-gathering system from the Miller Field and other fields in the central sector of the British North Sea.

Twenty-five significant oil and gas discoveries were made in the North Sea. This resulted in an estimated gas reserve in-

crease of about 2,100 billion cubic feet in discovered gasfields as well as in oil-gas reservoirs. This surpassed gas production by about 30%. Significant gas discoveries were made in the southern basin by Arco British Ltd. near the Thames Gasfield, by Phillips near the Hewett Gasfield, by Amoco 25 miles off Humberside and north of the Rough Field, by Conoco off Humber and by Mobil North Sea Ltd. in block 49/29 b-5. The Government awarded 15 blocks in the southern basin in the 10th exploration round. Appraisal of gas-condensate blocks in the ninth round had boosted interest and drilling activity in the gas-condensate-rich central North Sea.

Petroleum.—Oil production and proven reserves each decreased somewhat for the second consecutive year. Proven reserves of crude oil decreased by about 3% to approximately 5.2 billion barrels. Nevertheless, the Government modified its production forecast to show a less rapid decline in the 1990's. Improved production systems enabled newer fields to profit at the $18 per barrel average 1987 crude price. A study of the British petroleum production tax system, conducted by the University of Aberdeen, revealed that the system was sufficiently flexible to adjust fairly well to unforeseen changes in project profitability.

Four new oilfields with a combined production capacity of about 75 million barrels per year came on-stream. These were, in order of size, Total Oil Marine Ltd.'s North Alwyn, BP's Southeast Forties, Britoil's Clyde, and Mobil's Ness Field. The increased production did not offset decreased production in older fields, particularly in the Forties and Ninian Fields.

Late in the year, the Goverment authorized development of four new oilfields with a combined production capacity of approximately 75 million barrels per year. A project by Shell (UK) Exploration and Production (Shell Expro) Kittiwake Field was the first to receive development approval granted in 18 months. Peak production, 36,000 barrels per day, was to be transported by tanker. The gas byproduct was to be piped to the Fulmar Field and then to Fergus on the mainland. Amoco's Arbroath Field was similar in size to Kittiwake, and production from both was expected to begin by 1991. The two lesser fields were the Glamis Field of North Sea Sun Oil Ltd. and the much smaller Chanter Field operated by Occidental Petroleum (Caledonia) Ltd. Development costs were more favorable for Arbroath, Chanter, and Glamis because each was near an established field so that common facilities, especially transportation, could be shared.

Exploratory and appraisal drilling increased significantly during the last 4 months of 1987 to about the 1985 level. A total of 132 such wells were drilled during 1987. Discovered oil reserves approximated 860 million barrels. Kerr McGee Oil (UK) PLC's Eocene-crude strike was the most significant discovery. The reservoir, under 110 meters of water in block 9/186 and 200 miles east of Aberdeen, Scotland, near Mobil's Beryl Field, was conservatively estimated to contain 400 million barrels of oil and appeared to extend into Britoil's adjoining block 9/236. The second most significant oil find was the Alba trend, also Eocene oil, discovered jointly by Premier Consolidated Oilfields PLC and Chevron Petroleum (UK) Ltd. in blocks 162 and 222. Other significant finds were made by Amerada Hess Ltd. near its Ivanhoe-Rob Roy development, Occidental's strike in block 296a off Aberdeen, Amoco's discovery off northern Scotland near its Hutton Field, Texaco North Sea (UK) Co.'s. find near the Tartan Field, and BP's oil strike off the Dorset coast near Wytch Farn.

The Government's 10th exploration round culminated in the awarding in May of 51 North Sea blocks, about 40% of those offered. Industry mostly sought mature acreage near producing wells and was reluctant to enter high-cost frontier areas. The one exception was a block in the Rockal trough awarded to Occidental. The other areas, excluding the gas blocks in the southern basin, were, in order of area, the central North Sea, the Moray Firth area, and the northern North Sea.

Final Government approval was granted in June for expansion of the United Kingdom's largest onshore oilfield, at Wytch Farn in Dorset, to 60,000 barrels per day. The project included construction of a 17-kilometer, 15-inch pipeline to Southhampton. A second round of onshore licensing covering a 2,500-square-kilometer area produced 78 applications. Awards were to be announced in 1988. Onshore exploration was down in 1987.

The British Government's disposal of its remaining 32% ownership of BP began in

October as a public stock offering. Sales went badly because of the October collapse of the world stock market. The Kuwait Investment Office purchased much of the offering and held an 18% ownership in BP by yearend.

BP acquired at midyear its last 45% share of Standard Oil Co. for about $8 billion. Standard Oil, renamed BP America Ltd., thus became a fully owned subsidiary of BP. BP's U.S. assets then equaled about 50% of its world assets. BP also began its acquisition of Britoil and had purchased 30% of its shares by yearend for about $1 billion.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from pounds sterling (£) to U.S. dollars at the rate of (£)1.00=US$1.64, the average rate during 1987.

The Mineral Industry of Venezuela

By Harold R. Newman[1]

The economic growth of Venezuela slowed to 3.2% in 1987, compared with the 5.2% growth rate in 1986. Even so, it was the second-best performance of the non-oil sector of the economy since 1978. The Government continued to pursue a stimulative fiscal policy. Public investment expenditures increased 38% and resulted in a Central Government budget deficit of 7% of the gross domestic product (GDP). Despite a better than expected economic performance, the most serious disappointment was the 40% increase in the inflation rate. According to official figures, unemployment fell from 10% in 1986 to 8.5% at yearend. Venezuela continues to be heavily dependent on petroleum export earnings. In 1987, petroleum accounted for about 17% of the GDP, 52% of Central Government revenues, and 87% of export earnings.

Despite uncertainty about future petroleum prices, Petróleos de Venezuela S.A. (PDVSA) allocated about $2.6 billion[2] to a number of major projects in progress or anticipated. Annual investments of about $800 million for production and exploration were also planned. These investments could increase potential oil production levels to 2.7 million barrels per day. Petroquímica de Venezuela S.A. (PEQUIVEN), PDVSA's petrochemical subsidiary, was expected to seek foreign and domestic partners for petrochemical projects. PDVSA indicated that foreign partners would participate in the development of the Guasare coal deposit in Zulia State.

Venezuela became increasingly conscious of its mineral wealth, other than petroleum, and its potential in bauxite, coal, diamond, gold, iron ore, and natural gas production. The need to diversify its export earnings away from petroleum was leading Venezuela to produce more of its other mineral resources for export. Plans were under way to expand the country's primary aluminum production. Venezuela aims to become the world's second or third largest producer of aluminum. Projects were also under way to expand steel and petrochemical output. There was also planning to increase exports of cement, ceramics, and other mineral-related products.

In recognition of the need to restructure the mining industry, in May 1987, a new law was put before the Congress of Venezuela to establish a National Mining Council. The draft law proposed four alternative methods for conducting mining activities: direct exploitation by the Ministry of Energy and Mines (MEM); exploitation by state-run regional organizations; concessions to private firms with the Government having some rights to participate; and exploitation of industrial minerals, such as clay and gravel, by private firms under special permits. Exploration licenses would be issued for 3 years, while development concessions could be issued for up to 25 years. Taxes on profits, now 60%, would be reduced to 50%, as long as profits were less than 30 million bolivars (Bs) per year.

Existing mining laws were considered to be cumbersome and not conducive to orderly development of the sector. Development of a mining project by a private company required approval by at least seven ministries, the Central Bank, the Foreign Trade Institute (SIEX), the regional authority, and state and local governments. The lengthy process required a high degree of dedication and patience by the private investor.

Registered total foreign investment at yearend totaled $1.8 billion, with 60%

accounted for by U.S. investors. Despite liberalization of the foreign investment regulations in September 1986, new foreign investment increased by only $27 million in 1987. The December 1986 shift of cost of foreign investment from the free-market rate of Bs30.00=US$1.00 to Bs14.50=US$1.00 greatly increased the dollar cost of new foreign investment.

PRODUCTION

Petroleum production was 1.5 million barrels per day (bbl/d) with an additional 165,000 bbl/d of condensates and 94,000 bbl/d of gas liquids, which was a small decrease from that of 1986. Venezuela continued to maintain a production potential of 2.6 million bbl/d by increasing the proportions of light and medium crudes, instead of its traditional heavy-crude resources. Venezuela announced the commercial production of Orimulsion, a hydrocarbon slurry made from water and Cerro Negro Heavy crude from the Orinoco heavy-oil belt. The product was considered to be capable of competing with coal in thermal electrical generating plants. Plant tests were being conducted at New Brunswick Electric Power, Canada, which expected to burn about 800,000 barrels by yearend 1988. A process was also being developed to produce coke from extra-heavy petroleum to manufacture anodes for the aluminum industry.

The first alumina was refined from bauxite produced by C.V.G. Bauxita de Venezolana C.A.'s (BAUXIVEN) los Pijiguaos Mine in Bolívar State, at Interamericana de Alúmina C.A.'s (INTERALUMINA) plant at Ciudad Guayana, Bolívar State. This completed the vertical integration of the country's aluminum industry. Domestic and foreign iron ore sales by CVG Ferrominera del Orinoco C.A. (FERROMINERA) continued to improve, increasing from 15.5 million tons in 1986 to 17.2 million tons.

The Government tightened its control over mining and prospecting activities for gold in Bolívar State where most of the country's gold deposits are. Because of the remoteness of the area and close proximity to borders adjoining Brazil and Guyana, smuggling has been a problem. A gold exporting program was initiated by the Government, and 3 tons of gold valued at $45 million was sold by the Central Bank at yearend.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Alumina	560,000	1,139,000	1,085,000	1,296,000	1,347,000
Bauxite	--	--	--	--	217,000
Metal, unalloyed ingot	335,200	386,150	395,894	424,000	428,000
Gold, mine output, Au content troy ounces	[r]34,850	[r]55,975	[r]71,180	80,730	107,608
Iron and steel:					
Iron ore and concentrate thousand tons	9,449	[r]13,055	14,754	16,753	17,780
Metal:					
Pig iron do.	348	326	441	491	480
Sponge iron do.	2,418	2,486	2,635	2,918	3,190
Ferroalloys:					
Ferromanganese do.	2	2	2	(2)	--
Ferrosilicomanganese do.	9	9	22	29	28
Ferrosilicon[3] do.	46	44	61	51	50
Total do.	57	55	85	80	78
Steel, crude do.	2,558	[r]2,777	3,055	3,467	3,700
Semimanufactures, hot-rolled do.	1,919	[r]1,973	2,060	2,315	3,000
Lead, secondary, smelter[e]	15,000	17,000	18,000	16,000	17,000
INDUSTRIAL MINERALS					
Amphybolite	[r]258,000	169,081	183,296	297,000	243,000
Cement, hydraulic	4,444,104	4,783,000	5,294,000	5,747,000	6,110,000
Clays:					
Kaolin	[r]16,000	[r]12,540	[r]19,000	14,906	30,000
Other thousand tons	1,839	1,868	1,928	1,648	1,968

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Diamond:					
Gem ---------- carats	45,367	40,739	47,400	42,000	41,000
Industrial ---------- do	233,553	232,183	167,900	180,000	72,000
Total ---------- do	278,920	272,922	215,300	212,000	113,000
Feldspar ----------	37,400	[r]40,497	42,440	36,000	43,000
Gypsum ----------	204,600	142,386	188,754	257,000	247,000
Lime, hydrated ----------	[e]2,000	--	--	--	--
Nitrogen: N content of ammonia ----------	379,652	463,000	490,300	654,600	625,000
Phosphate rock ----------	[r]3,000	[r]3,265	8,567	173,000	103,000
Pyrophyllite ----------	15,000	15,500	18,700	25,000	32,000
Salt, evaporated ----------	310,650	[r]280,700	338,889	511,421	500,000
Senpentinite, crushed ----------	325,500	345,255	517,117	553,550	580,000
Stone, sand and gravel:					
Stone:					
Dolomite ---------- thousand tons	239	87	274	303	257
Granite ----------	770,970	[r]335,726	655,587	530,000	287,000
Limestone ---------- thousand tons	[r]12,209	[r]11,561	13,906	15,686	15,929
Marble ---------- cubic meters	455	169	272	549	671
Sand and gravel ---------- thousand tons	[r]5,826	[r]5,989	[r]6,338	6,545	6,829
Sand, glass ---------- do	[r]230	[r]334	297	349	450
Sulfur, byproduct of petroleum and natural gas[e]	85,000	86,000	35,100	99,380	96,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[e] ---------- thousand tons	18	51	55	41	61
Coal, bituminous ----------	39,100	50,870	41,427	57,641	93,000
Gas, natural:					
Gross ---------- million cubic feet	1,222,100	1,150,364	1,165,088	1,280,870	1,060,000
Marketable ---------- do	508,460	517,664	498,159	576,390	465,300
Natural gas liquids:[4]					
Natural gasoline thousand 42-gallon barrels	4,483	4,708	6,885	6,687	6,500
Liquefied petroleum gas ---------- do	13,949	13,945	15,849	15,007	15,000
Total ---------- do	18,432	18,653	22,734	21,694	21,500
Petroleum:					
Crude[5] ---------- do	657,365	[r]659,942	[r]613,581	653,563	603,594
Refinery products:					
Gasoline:					
Aviation ---------- do	430	539	373	277	286
Motor ---------- do	67,500	46,100	59,994	88,470	76,884
Jet fuel ---------- do	14,500	14,486	18,263	20,770	21,229
Kerosene ---------- do	4,440	4,277	21,648	32,060	2,768
Distillate fuel oil ---------- do	67,510	69,744	92,870	87,470	76,884
Residual fuel oil ---------- do	108,740	117,466	107,987	96,620	89,760
Lubricants ---------- do	[e]2,400	2,340	2,343	2,453	2,566
Liquefied petroleum gas ---------- do	[e]2,000	1,868	15,848	2,824	32,640
Asphalt and bitumen ---------- do	8,660	8,930	10,215	11,980	11,983
Naphtha ---------- do	[e]10,000	19,800	21,249	15,750	18,760
Refinery gas[6] ---------- do	9,200	12,020	7,844	9,862	7,400
Unspecified ---------- do	27,260	27,813	20,754	22,330	22,640
Total ---------- do	322,640	325,383	379,388	390,866	363,800

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

[1]Table includes data available through June 30, 1988.

[2]Revised to zero.

[3]Figures represent combined 45% silicon content and 75% silicon content production.

[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: 1983—3,127; 1984—3,156; 1985—not available; 1986—5,380; and 1987—not available. Natural gasoline is included as follows, in thousand 42-gallon barrels: 1983—229; 1984—249; 1985—219; 1986—247; and 1987—230.

[6]Liquid equivalent.

TRADE

Venezuela's trade surplus in 1987 declined by slightly more than the $5.7 million decrease in its petroleum export revenues. Although nonpetroleum exports rose almost 12%, they were still small in comparison to the decline in petroleum revenues. Declining oil income and the resulting loss of budgetary revenues and foreign exchange

reserves continued to be a major concern of the Government. INTERALUMINA continued to produce alumina in excess of domestic requirements, and about 500,000 tons was exported in 1987. FERROMINERA exported 11.7 million tons of iron ore in 1987. Venezuela and the European Economic Community (EEC) signed an agreement establishing access to the European market for 72,000 tons of steel products in 1987. Venezuela's chemical and petrochemical industries generated about $250 million in foreign exchange in 1987. FERROMINERA negotiated a barter agreement with Marubeni Corp. of Japan to swap 240,000 tons of iron ore for two telephone control stations.

Venezuela has shifted from being simply an exporter of crude petroleum and petroleum products to being a seller of petroleum products refined at various locations. This was the result of the big expansion of its overseas refining locations during 1985-86 through joint ventures and leasing of the Curaçao refinery. The program of 50-50 joint ventures now includes AB Nynas-Petroleum (Sweden), Veba Oel AG (Federal Republic of Germany), Citgo Petroleum Corp., and Champlin Petroleum Co. (United States). These overseas ventures serve the dual purpose of ensuring placement of Venezuelan crude oil exports and giving PDVSA profits from downstream marketing and distribution. Slightly more than one-half of Venezuela's 1987 petroleum exports went to the United States, with 18% going to Europe, 11% to Latin America and the Caribbean, not including the 12% to the refineries in Curaçao and Aruba.

Venezuela was not a member of the General Agreement on Tariffs and Trade (GATT). The decision by the Government in 1987 to study the issue of GATT membership was considered to be very significant and indicated an awareness that the country needs a broader-based participation in the world economy if it is to diversify exports.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—Corporación Venezolana de Guyana (CVG) signed a letter of intent with Aluminum Co. of America (Alcoa) and Suramericana de Aleaciones Laminados (Sural) to build a 120,000-ton aluminum smelter near Puerto Ordaz. The plant will cost approximately $375 million and will use Alcoa technology. Alcoa and Sural will each own 40% of the smelter, with CVG holding the remaining 20% share. The smelter was expected to be operational within 3 years, with 80% of the production destined for export markets.

Aluminio del Caroní S.A. (ALCASA) signed a Bs520 million loan agreement with a group of private domestic banks led by Banco Consolidado to finance ALCASA's expansion plans. Also, Industria Venezolana de Aluminio C.A. (VENALUM) signed a Bs400 million loan agreement with a group of domestic banks led by Banco Latino to finance the company's expansion plan. The new credit line adds to the $54 million loan agreement with the West German bank Kreditanstal Fuer Wiederareifbau to assist in the expansion of VENALUM's production capacity from 280,000 tons to 450,000 tons per year over the next 3 years.

These agreements underline foreign and domestic investors' confidence in the future of Venezuela's aluminum industry, which is expected to be one of the world's lowest cost producers because of abundant bauxite, inexpensive hydroelectric power, and basic infrastructure. The industry's direct smelting costs were estimated at $18 per pound and investment costs at about $3,000 per ton of installed capacity.

Mining was started in 1987 at C.V.G. Bauxita Venezolana C.A.'s (BAUXIVEN) Los Pijiguaos Mine in the Cedano District, southeast Bolívar State. The first alumina was refined from Los Pijiguaos bauxite at the INTERALUMINA plant in Puerto Ordaz, thus completing the vertical integration of the Venezuelan aluminum industry. BAUXIVEN was expected to produce 3 million tons of bauxite per year by 1990, with an increase to 6 million tons per year by 1992. Any bauxite excess to the needs of the domestic market would be refined and exported as alumina. The INTERALUMINA refinery produced more than 1 million tons of alumina in 1987, and a decision was made to increase capacity to 2 million tons per year by the end of 1991 at an estimated cost of $470 million. About 500,000 tons of alumina was exported in 1987. Los Pijiguaos has proven reserves of 200 million tons and probable reserves of an additional 500 million tons. FERROMINERA discovered a large deposit of high-grade bauxite near

Upata, about 70 kilometers southeast of Ciudad Guyana. Reserves were estimated at 100 million tons.

Gold.—Venezuelan gold reserves, estimated at 11.5 million troy ounces, are the largest in Latin America. The country is estimated to have 12% of the world's known gold reserves. This gold potential mostly had been ignored in the country's petroleum-centered economy. However, the fall in the price of petroleum on the world market and the pressures of external indebtedness have caused the Government to promote alternative exports, including gold, derived from the country's considerable mineral wealth. A gold exporting program was begun in 1987, and 3 tons of gold valued at $45 million was sold in December 1987. The target for exports of domestically mined gold in 1988 was 15 tons with an expected value of $300 million.

Monarch Resources Ltd., a Bermuda-based company, was formed in 1986 to serve as a holding company for several subsidiaries. Monarch has become a partner with CVG in several joint-venture gold exploration and mining projects in Venezuela. These projects are in the El Callao area, Bolívar State, and include management of the Columbia Mine by a Monarch subsidiary, Projectos Tecnicos Mineros C.A. (Protemin); exploration and mining of Monarch's interest in six concessions around El Callao, totaling 6,000 hectares; participation in the planned expansion of the Colombia concentrator, increasing capacity to 830 tons of ore per day; and reevaluation of the El Callao Mine, which had been shut down for several years. Revemin II C.A., another Monarch subsidiary, was to build an 800-ton-per-day processing plant to extract gold from the Mocupia Gorge tailings using carbon-in-pulp treatment. These tailings are estimated to contain 200,000 ounces of gold at an 85% recovery rate.

Greenwich Resources Venezuela S.A., a subsidiary of Greenwich Resources PLC (United Kingdom), was continuing to explore, develop, and exploit its mining concession in the Pastora complex of northeast Venezuela. The company was reported to be planning a mine south of El Dorado, Bolívar State. Greenwich Resources and Monarch were the first foreign companies to be given gold-mining permits since 1934.

The Geological Survey of Venezuela outlined several important alluvial zones containing gold and palladium in the central Amazonas Territory along the Guapuchi River. Some of these potential areas were being exploited.

Iron Ore.—FERROMINERA continued to increase production from the San Isidro Mine. Combined production from the San Isidro and Cerro Bolívar Mines was more than 14 million tons, and the El Pao Mine produced almost 3 million tons. Work was continuing on converting the Minerales Ordaz C.A. (MINORCA) iron briquet plant to a direct-reduction iron (DRI) plant by Kobe Steel Ltd. Completion of the floating transshipment station on the Orinoco River was expected in 1988. This topping-off system would allow FERROMINERA to increase the size of bulk carriers used for iron ore and load vessels too large to enter the Orinoco channel. The consortium selected to build and operate the project was Nippon Karan K.K., Marubeni Venezuela, Mitsubishi Venezolana, J. J. McMullen Co. of the United States, and Orinoco de Navegacion S.A.

The most important and costly project FERROMINERA was involved in was the construction of a 3-million-ton-per-year iron ore pellet plant. The project was originally announced in mid-1986, and a decision to construct the plant was expected in early 1988.

Iron and Steel.—C.V.G. Siderúrgica del Orinoco C.A.'s (SIDOR), Venezuela's largest steelmaker, net profits were down from $70 million in 1986 to $27 million in 1987. This was due mainly to the servicing of the company's long-term foreign debt. Production and efficiency continued to increase in 1987, and SIDOR was seeking to expand its export markets.

Siderúrgica Venezolana S.A. (Sivensa) was proceeding with construction of a DRI plant to produce 400,000 tons per year of hot-briquetted Midrex sponge iron. Sivensa will operate the plant under the name Siderúrgica del Caroní S.A.

Other Metals.—C.V.G. Ferrosilicio de Venezolana C.A. (FESILVEN) was planning a significant increase in its ferrosilicon output. The company was also considering producing silicon metal. FESILVEN intended to boost ferrosilicon capacity from 50,000 tons per year to 90,000 tons per year by 1988. More than 80% of FESILVEN's production was exported.

INDUSTRIAL MINERALS

Cement.—The Venezuelan cement industry was made up of eight companies with Venezolana de Cementos C.A. (VENCEMOS) as the principal producer. Increased

domestic sales and exports stimulated an increase in 1987 production, which was reported to be more than 6 million tons. The industry was running at more than 90% of capacity. Export levels were expected to decline as the domestic market expands unless additional capacity is added. Venezuela has not imported any cement since 1983.

Other Industrial Minerals.—MEM continued exploration efforts in Guárico and Zulia States for barite. Several large deposits were outlined. New feldspar mines were opened in the Tinaquillo area, Cojedes State. A gypsum open pit was under development in southern Sucre State. The mine was expected to produce 300,000 tons annually. Two pyrophyllite mines were opened in central Lara State to supply material for the paint and cement industries. Geological investigations were under way in the Tinaquillo complex to evaluate asbestos, bentonite, and magnesite deposits.

MINERAL FUELS

Coal.—Carbones del Zulia C.A. (CARBOZULIA), a subsidiary of PDVSA, signed a preliminary development agreement with a group consisting of subsidiaries of Atlantic Richfield Co. of the United States and Ente Nazionale Idrocarburi (ENI) of Italy, for the development and marketing of coal from the Guasare region of Venezuela. The Guasare coal project will be owned 49% by CARBOZULIA, 43% by the consortium, and 8% by private investors of Venezuela. The foreign companies are ACC Venezuela Inc., a unit of Arco Coal Co., which is a subsidiary of Atlantic Richfield, and Agip Carbone, a subsidiary of ENI. The consortium will be developing one of the largest remaining undeveloped coal deposits in the Western Hemisphere. Once in operation at its planned production rate of 6.5 million tons per year, the proposed project would be a formidable competitor in the world steam coal market. The Guasare region covers 8,250 hectares and contains an estimated 320 million tons of recoverable steam coal, although the region's total coal reserves are estimated to be much higher. Formalization of the joint venture was delayed by the foreign partners because of the exchange rate that would be applied to the foreign investment and the uncertainty of what exchange rate would be applied for remitting future profits.

Production in 1987 was about 127,000 tons, of which 60,000 tons was shipped to France and Italy for testing.

The Government was also developing a mining project in Táchira State to reduce imports of coke. The coking-coal deposits near the towns of Gobatera, Rubio, and Las Adjuntas will be mined by the state company Carbones del Suroeste C.A., trucked to a river port, and barged down the Apure River to the Orinoco River. The Government was planning to build a 36,000-ton-per-year coke plant to handle the 700,000 tons per year of mined coal. The coke would be used by the plants in the Guyana industrial area.

In Anzoátigui State, Vencemos Cavosa C.A. (CAVOVEN), a joint-venture company 60% owned by VENCEMOS and 40% owned by the Spanish company Compañía Auxiliar de Voladuras (CAVOSA), was developing the Fila Maestra coal project toward an output of 700,000 tons per year of steam coal. The mine produced about 150,000 tons of coal in 1987. All the production will be for export through the port of Guanta.

Petroleum and Natural Gas.—As a result of new discoveries of light and medium crude oil in El Furrial and Musipan, in Monagas State, and other discoveries south of Lake Maracaibo in 1987, Venezuelan proven crude oil reserves were estimated to be 58 billion barrels. A large proportion of these reserves consist of light and medium crudes. Natural gas reserves were estimated to be 92 trillion cubic feet.

Through its "internationalization" program of 50-50 joint ventures in refining operations in consuming countries, PDVSA was able to place 450,000 bbl/d in overseas refineries and expected to be able to increase shipments to a total of 700,000 bbl/d. The process capacity of PDVSA's refineries in Venezuela and overseas at yearend was as follows:

Refinery location	Process capacity (thousand barrels per day)	PDVSA's share (percent)
Venezuela:		
Amuay	600	100
Bajo Grande	57	100
Cardon	260	100
El Palito-El Toreno	109	100
Puerto La Cruz	192	100
San Roque	5	100
Federal Republic of Germany:		
Horst	100	50
Karlsruhe	142	32
Neustadt	144	25
Scholven	130	50
Sweden:		
Antwerp	15	50
Gothenburg	12	50
Nynashamn	28	50
United States:		
Champlin Petroleum Co.	173	50
Citgo	330	50

The $1 billion Nurgas pipeline, designed to bring natural gas from the gasfield of eastern Venezuela to the central and western parts of the country, was under construction.

PDVSA's petrochemical subsidiary, PEQUIVEN, continued construction of new facilities to produce chlorine, ethylene, olefins, plastics, and propylene at the El Tablazo petrochemical complex in Zulia State. In 1987, PEQUIVEN produced more than 2 million tons of petrochemical products, the highest figure ever.

PEQUIVEN also signed a joint-venture agreement with Ecofuel, a subsidiary of ENI of Italy, to form a new company called Super Octanos C.A. to produce 500,000 tons per year of methyl terciary butyl ether (MTBE), a nonlead additive to raise the octane level of gasoline. Estimated investment in the MTBE plant, to be at Jose, would be $145 million.

The Government announced that it would build a 70,000-ton-per-year polypropylene plant using Mitsui Petrochemical Industries of Japan technology. The plant would be at PEQUIVEN's Zulia complex and cost an estimated $133 million. Partners in the new joint venture, Polipropylene de Venezuela S.A., are PEQUIVEN, 49.4%; Mitsui, 20.2%; and two private-sector groups, 15.2% each. Polypropylene was the only major type of plastic not currently produced in Venezuela.

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[1]Physical scientist, Division of International Minerals.

[2]Unless otherwise specified, values have been converted from Venezuelan bolivars (Bs) to U.S. dollars at the rate of Bs14.50=US$1.00.

The Mineral Industry of Yugoslavia

By Walter G. Steblez[1]

Yugoslavia remained a producer of a broad range of mineral commodities. Although by world standards the country was not a dominant producer of any one mineral or fuel, Yugoslavia was by European standards an important producer of antimony, bauxite, copper, lead, and zinc. The country was also an important producer of a wide variety of industrial minerals. In 1987, Yugoslavia's economy showed a significant downturn. The gross domestic product declined for the first time in 4 years and industrial production increased only slightly. The rate of inflation, the highest since the end of World War II, rose by 170% in 1987. Industrial imports also declined, reducing needed supplies of machinery and equipment for the mining industry, which adversely affected mineral production during the year. Major events in the mineral industry in 1987 included serious financial difficulties at the Trepca lead-zinc mining and beneficiation complex in Kosovo, the construction startup of the third stage of the Zeljezara-Zenica steelworks, the commissioning of a new iron ore concentrator at the Sisak steelworks in Croatia, the modernization of the Kirdicevo aluminum works, and the development plan for the Rudnik Boksita Vlasenica bauxite deposit in Bosnia. In the energy field, construction startup of a new brown coal mine began at Petisevskoye Polje near the Hungarian border.

Government Policies and Programs.—Since 1945, the Socialist Federal Republic of Yugoslavia, a federation consisting of the Serbian, Croatian Slovenian, Macedonian, Bosnian-Herzegovinian, and Montenegrin Republics, developed along centrally planned economy lines. The country's economy not only showed many features in common with other East European centrally planned economy countries, but also several important differences. Although the Yugoslav economy and mineral industry operated under the state-owned enterprise system, mining and other industrial enterprises were relatively independent in respect to maximizing profits as long as general economic guidelines were met. State-owned enterprises operated in accordance with the Law of Self-Management by Workers Councils, which gave workers direct participation in enterprise management. Government regulations adopted in 1984 eliminated the 49% ceiling on foreign investment equity and removed restrictions on profits that could be earned and repatriated by foreign investors. However, foreign partners in a joint venture were entitled to only 50% representation in venture management regardless of the amount of equity held. Since 1984, foreign investment in Yugoslavia's mineral industry was involved primarily in the country's mineral fuels sector.

To control inflation and promote production and exports, the Government adopted measures in November that included administrative wage and price controls. The rate of inflation was reduced but was not brought down to manageable levels by year-end. Also, the Government negotiated with the International Monetary Fund to reschedule Yugoslavia's foreign debt to attract new foreign credits.

To reduce the country's dependence on imported energy, the Government planned to invest about $8.1 billion (Yugoslav evaluation) to further develop domestic energy sources, largely coal, natural gas, and petroleum, by the turn of the century. A Government study of Yugoslavia's mineral in-

dustry capacity and prospects through 1999 indicated a planned 30% increase in the output of primary aluminum by the year 2000 compared with that of 1986. Similarly, the production of copper would increase by 21%, that of lead by 88%, and that of zinc by 107%. To achieve these output levels, an investment of $3.4 billion would be required for the exploration of new ore reserves, development of new mines, and the upgrading of existing infrastructure.

PRODUCTION

The planning of mining output and other industrial activity remained decentralized and subject only to general economic guidelines set by the Government. Major enterprises in the country's mineral industry were Energoinvest (aluminum), Rudarsko Metalurski Kombinat (RMK) Zajaca (antimony), Dalmacija Cement (cement), Rudarsko Topionicarski Bazen (RTB) Bor (copper), Jugohrom (ferroalloys), RMK Zenica (iron and steel), Rudarsko-Metalursko-Hemijski Kombinat Olovo i Cink (RMHK) Trepca (lead and zinc), and INA Zagreb (oil, gas, and refinery products). The output of most sectors of the mineral industry declined compared with those of 1986 with the exception of those involving the extraction and refining of petroleum and natural gas. Despite an increase in the mine production of coal, the output of clean marketable product declined by 12%. Likewise, the output of iron and steel declined by 3%, and that of nonferrous metal ores, nonferrous metals, and semimanufactures by 5%, 2%, and 6%, respectively. The production of industrial minerals also declined slightly.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Bauxite thousand tons	3,500	3,347	3,250	3,459	[3]3,394
Alumina do	1,010	1,135	1,138	1,117	[3]1,113
Metal ingot:					
Primary[e]	[3]258,174	270,000	280,000	282,000	244,000
Remelted[e 4]	[3]25,385	31,567	36,092	37,670	37,084
Total	283,559	301,567	316,092	319,670	[3]281,084
Antimony:					
Mine and concentrator output:					
Ore, gross weight	50,961	51,000	71,000	61,000	[3]48,000
Sb content of ore	950	945	1,088	859	[3]834
Concentrate, gross weight	2,072	2,844	3,000	[e]2,800	4,300
Metal (regulus)	895	1,263	1,502	1,830	[3]1,002
Bismuth, smelter output	45	30	68	21	[3]73
Cadmium, smelter output	48	270	279	259	305
Chromium: Chromite concentrate (produced largely from imported ores)	[3]76,935	[3]110,022	75,000	75,000	102,000
Copper:					
Mine and concentrator output:					
Ore, gross weight thousand tons	23,443	25,279	26,166	27,864	[3]27,745
Cu content of ores[e]	[r 3]129,500	[r 3]137,575	[r]141,200	[r]144,800	138,700
Concentrate, gross weight thousand tons	543	609	582	536	[3]514
Metal:					
Blister and anodes:					
Primary	86,833	84,657	[r e]84,500	[r e]84,500	75,000
Remelted[4]	80,903	91,679	[r e]104,500	[r e]103,500	90,000
Total	167,736	176,336	189,000	188,000	[3]165,000
Refined:					
Primary	82,925	80,259	[r e]80,000	[r e]81,000	80,500
Remelted[4]	40,783	47,352	[r e]55,000	[r e]59,393	58,367
Total	123,708	127,611	[r e]135,000	140,393	[3]138,867
Gold, refined troy ounces	136,250	125,130	[e]110,000	[e]115,000	157,500
Iron and steel:					
Iron ore:					
Gross weight thousand tons	5,018	5,321	5,478	6,618	[3]5,983
Fe content do	1,529	1,837	[e]1,800	[r e]2,000	1,800

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
METALS —Continued					
Iron and steel —Continued					
Iron concentrate, gross weight thousand tons	[r]2,424	2,503	2,482	2,995	[3]3,247
Metal:					
Pig iron do	2,845	2,855	3,120	3,063	[3]2,868
Ferroalloys:					
Ferrochromium	63,807	75,441	[r e]50,000	[r e]50,000	50,000
Ferromanganese	39,677	47,375	[r e]40,000	40,000	40,000
Ferrosilicon	78,014	94,075	[e]93,000	90,000	90,000
Silicon metal	26,256	28,428	[r e]28,000	[r e]35,000	30,000
Ferrosilicomanganese	26,254	37,214	[e]67,000	65,000	61,000
Ferrosilicochromium	5,998	10,721	[r e]10,000	[r e]10,000	10,000
Other	[r]10,691	10,571	[e]11,000	[r e]10,000	10,000
Total	[r]250,697	[r]303,828	299,000	300,000	[3]291,000
Steel, crude:					
From oxygen converters thousand tons	1,598	1,644	1,801	1,769	[3]1,715
From Siemens-Martin furnaces do	1,432	1,440	1,524	1,509	[3]1,301
From electric furnaces do	1,105	1,152	1,155	1,241	[3]1,351
Total do	4,135	4,236	4,480	4,519	[3]4,367
Semimanufactures do	4,649	5,667	5,694	5,411	[3]6,260
Lead:					
Mine and concentrator output:					
Ore, gross weight (lead-zinc ore) do	4,063	4,634	4,590	4,588	[3]3,908
Pb content of ores	[r]114,385	[r]113,648	[r e]115,100	[r e]103,000	82,000
Concentrate, gross weight	144,010	148,026	[e]145,000	[e]145,000	133,800
Metal:					
Smelter:					
Primary	93,112	109,719	[r e]116,700	[r e]129,900	126,000
Secondary[5]	34,000	[r]11,548	[r e]15,000	[r e]21,000	20,000
Total	127,112	121,267	[r e]131,700	[r e]150,900	146,000
Refined:					
Primary[6]	[r]64,531	45,415	[r e]59,954	74,654	74,000
Secondary	[r]33,000	37,400	[r e]40,000	38,500	38,000
Total	97,531	82,815	99,954	113,154	112,000
Magnesium metal	4,763	5,139	[e]4,500	[r e]4,900	5,900
Manganese ore:					
Gross weight	31,643	21,079	[e]25,000	[e]25,000	28,000
Mn content	11,074	6,736	[e]9,500	9,500	9,800
Mercury[e] 76-pound flasks	1,500	1,700	1,800	1,800	2,900
Nickel, mine output:[e]					
Ore, gross weight thousand tons	500	600	800	700	750
Ni content of ore	[r]1,600	[r]2,200	[r]2,800	[r]3,200	3,500
Ni content of ferronickel	[r]1,000	[r]1,800	[r]2,800	[r]3,200	3,500
Platinum-group metals:					
Palladium troy ounces	2,926	3,476	[e]3,300	[e]3,100	3,200
Platinum do	193	386	[e]250	[e]250	96
Selenium metal, refined kilograms	43,782	45,211	[e]46,000	[e]47,400	47,700
Silver, metal refined including secondary thousand troy ounces	3,987	4,051	5,015	5,690	[3]4,855
Zinc:					
Zn content of lead and zinc ore	86,767	85,761	89,300	[r e]94,600	89,500
Concentrator output, gross weight	143,809	149,124	[r e]155,000	[r e]160,000	135,000
Smelter including secondary	88,049	92,649	83,398	89,286	[3]118,067
INDUSTRIAL MINERALS					
Asbestos, all kinds	10,502	8,556	6,916	8,596	[3]10,964
Barite	35,025	41,098	[e]35,000	[e]35,000	35,800
Cement, hydraulic thousand tons	9,592	9,315	9,028	9,127	[3]8,963
Clays:					
Ceramic clay, crude	98,903	57,666	258,000	290,000	[3]288,000
Fire clay:					
Crude	[r]343,799	249,613	227,000	213,000	[3]174,000
Calcined	54,551	50,370	[e]65,000	[e]65,000	47,000
Kaolin	208,254	201,822	[r e]205,000	[r e]210,000	247,000
Feldspar, crude	41,372	33,917	49,000	48,000	[3]45,000
Gypsum:					
Crude	622,942	606,636	[r e]610,000	[r e]620,000	580,000
Calcined	93,997	91,809	83,000	88,000	[3]74,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Lime:					
Quicklime thousand tons	1,696	1,997	r e1,950	r e1,750	1,790
Hydrated do	853	760	r e757	r e905	708
Total do	2,549	2,757	2,707	2,655	2,498
Magnesite:					
Crude	303,965	r326,099	e417,000	423,000	3403,000
Sintered	137,680	156,487	170,000	162,000	3149,000
Caustic calcined	11,527	13,743	14,279	14,420	310,217
Mica, all grades	946	r157	r e600	r e700	800
Nitrogen: N content of ammonia thousand tons	r500	609	766	667	3937
Pumice and related volcanic materials: Volcanic tuff	3504,814	500,000	510,000	500,000	510,000
Quartz, quartzite, glass sand:					
Quartz and quartzite thousand tons	201	262	e220	e225	3107
Glass sand do	2,391	2,141	2,337	2,406	32,417
Total do	2,592	2,403	2,557	2,631	32,524
Salt:					
Marine	28,874	44,151	e45,000	e48,000	348,000
From brines	194,709	188,839	e192,000	e194,000	3194,000
Rock	191,885	146,552	e173,000	e262,000	3258,000
Total	415,468	379,542	410,000	504,000	3500,000
Sand and gravel excluding glass sand thousand cubic meters	r24,206	r21,462	22,136	21,841	319,779
Sodium compounds: Sodium carbonate	183,374	188,291	199,629	207,968	3201,539
Stone excluding quartz and quartzite:					
Dimension:					
Crude:					
Ornamental thousand cubic meters	74	NA	NA	NA	NA
Other do	13	NA	NA	NA	NA
Partly worked facing thousand square meters	2,139	2,273	2,544	2,847	33,047
Cobblestones, curbstones, other thousand cubic meters	63	NA	NA	NA	NA
Dolomite thousand tons	954	1,522	1,716	2,306	3616
Shale do	7,936	7,111	7,314	7,888	37,771
Crushed and broken, n.e.s. thousand cubic meters	3,156	NA	NA	NA	NA
Milled marble and other do	8,800	NA	NA	NA	NA
Sulfur, pyrite, pyrrhotite:					
Pyrite, gross weight thousand tons	694	609	507	759	3609
Pyrrhotite, gross weight do	17	20	e20	20	20
Sulfur:					
Sulfur content of pyrite[7] do	291	255	213	319	3256
Sulfur content of pyrrhotite[7] do	7	8	e8	e8	8
Byproduct:					
Of metallurgy[e] do	180	160	170	175	175
Of petroleum[e] do	3	3	3	3	3
Total do	481	426	e394	505	442
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[e]	324,690	24,000	25,000	25,000	25,000
Coal:					
Bituminous thousand tons	392	389	400	407	3379
Brown do	11,303	11,391	12,465	13,099	312,135
Lignite do	46,889	53,651	56,635	56,626	359,359
Total do	58,584	65,431	69,500	70,132	71,873
Coke:					
Metallurgical do	3,028	3,083	e3,000	e3,000	2,500
Breeze do	249	269	e345	e296	260
Foundry do	163	163	e200	e200	200
Total do	3,440	r3,515	3,545	3,496	32,960

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity[2]	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Gas:					
Manufactured (excluding petroleum refinery gas):					
From coke plants ___ million cubic feet	39,658	NA	NA	NA	NA
From lignite gasification plants ___ do ___	3,672	NA	NA	NA	NA
Natural, gross production ___ do ___	73,816	70,523	84,755	86,415	[3]101,954
Natural gas plant liquids: Propane and butane thousand 42-gallon barrels	1,079	NA	NA	NA	NA
Petroleum:					
Crude:					
As reported ___ thousand tons	4,125	4,044	4,149	4,140	[3]3,867
Converted ___ thousand 42-gallon barrels	30,554	29,954	30,731	30,665	28,685
Refinery products:					
Gasoline ___ do ___	22,283	33,175	31,221	34,603	[3]34,076
Liquefied petroleum gas ___ do ___	2,660	NA	NA	NA	NA
Jet fuel ___ do ___	2,430	NA	NA	NA	NA
Kerosene ___ do ___	182	NA	NA	NA	NA
Middle distillate fuel oil ___ do ___	9,373	NA	NA	NA	NA
Distillate fuel oil ___ do ___	25,856	27,273	25,341	27,766	[3]28,062
Residual fuel oil ___ do ___	36,203	32,560	30,156	37,409	[3]44,170
Lubricants ___ do ___	3,227	3,171	4,228	4,494	[3]4,830
Paraffin ___ do ___	181	NA	NA	NA	NA
White spirit ___ do ___	289	NA	NA	NA	NA
Asphalt and bitumen ___ do ___	4,123	NA	NA	NA	NA
Petroleum coke ___ do ___	240	NA	NA	NA	NA
Other ___ do ___	249	NA	NA	NA	NA
Total ___ do ___	107,296	NA	NA	NA	NA

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

[1]Table includes data available through Nov. 1988.

[2]In addition to the commodities listed, 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]Includes undetermined quantity of secondary raw material.

[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]Calculated from pyrite and pyrrhotite concentrate using 42% as average sulfur content.

TRADE

By yearend, the National Bank of Yugoslavia reported a surplus of $1.037 billion in convertible currency current accounts, owing largely to a 5% reduction of imports and a virtually identical level of exports in 1987, compared with those of 1986. The Soviet Union remained Yugoslavia's chief trading partner, accounting for about 22% of the country's total world trade. Despite Yugoslavia's longstanding large-scale exports of bauxite to the U.S.S.R., on balance Yugoslavia's exports consisted of machinery and equipment in return for basic fuels and raw materials. In 1986, the Governments of Yugoslavia and the U.S.S.R. signed a commercial agreement for the 1986-90 period that called for exchanges of trade goods worth $37 billion. Because trade arrangements between the two countries were made on the basis of exchanging prearranged volumes and quantities of goods valued at world market prices, sharp fluctuations of world commodity prices often resulted in slow quantitative adjustments in the trade. Owing to a rapid decline in petroleum prices in 1986, by yearend Yugoslavia shipped goods valued at about $1.2 billion for which it did not receive compensation. The trade imbalance carrried over into 1987, with the Soviet Union refusing to make up the deficit with additional petroleum deliveries and Yugoslavia refusing to accept payment in Soviet-made manufactured goods.

Reportedly, Yugoslavia's exports to the U.S.S.R. in the first half of 1987 declined by 18% compared with those of the same period in 1986. By yearend the imbalance was largely corrected, and total Soviet exports to Yugoslavia increased by 118%,

with the crude petroleum component rising by 108%. Yugoslav exports to the U.S.S.R. in the second half rose by about 53%. The United States remained Yugoslavia's fourth-largest trading partner. The U.S. imports from Yugoslavia included ferroalloys, copper, and copper products, while U.S. exports included coal and coke.

Table 2.—Yugoslavia: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkaline-earth metals	(2)	(2)	--	All to Guinea.
Aluminum:				
Ore and concentrate	803,675	765,127	--	U.S.S.R. 386,730; Romania 225,646; Czechoslovakia 106,451.
Oxides and hydroxides	432,440	582,290	20	U.S.S.R. 534,410; Romania 15,000; Poland 12,883.
Metal including alloys:				
Scrap	265	1,420	--	Italy 1,117; West Germany 224; Austria 79.
Unwrought	142,699	142,227	51	Italy 38,460; France 29,802; East Germany 23,280.
Semimanufactures	66,736	84,291	10,632	Czechoslovakia 15,308; Italy 13,877.
Arsenic: Oxides and acids	--	(2)	--	All to Sweden.
Cadmium: Metal including alloys, all forms	55	23	--	All to Czechoslovakia.
Chromium:				
Ore and concentrate	13,150	7,919	--	Do.
Oxides and hydroxides	1	--		
Columbium and tantalum: Metal including alloys, all forms, tantalum	--	1	--	All to West Germany.
Copper:				
Ore and concentrate	85,391	15,000	--	Do.
Sulfate	5,433	6,875	--	Greece 3,002; China 2,000; Canada 600.
Matte and speiss including cement copper	933	--		
Metal including alloys:				
Scrap	2,436	1,634	--	Italy 983; Switzerland 651.
Unwrought	3,392	13,682	--	Italy 6,627; United Kingdom 2,962; East Germany 1,770.
Semimanufactures	30,995	32,674	3,805	West Germany 6,687; Italy 4,737.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	--	4	--	All to West Germany.
Pyrite, roasted	59,727	29,143	--	Hungary 16,731; Austria 12,412.
Metal:				
Scrap	173,419	157,542	--	Italy 144,280; Austria 7,896; Hungary 2,527.
Pig iron, cast iron, related materials	19,741	14,810	--	Italy 8,022; West Germany 2,996; East Germany 785.
Ferroalloys:				
Ferrochromium	52,752	46,404	21,133	Austria 8,828; Italy 5,511; Sweden 2,924.
Ferromanganese	7,650	5,883	--	Italy 3,400; Albania 1,343; Austria 1,091.
Ferrosilicomanganese	35,860	29,168	20,639	Turkey 2,500; Italy 2,137.
Ferrosilicon	52,706	58,357	2,393	Japan 16,291; Italy 12,904; Austria 11,069.
Silicon metal	27,063	24,835	2,184	U.S.S.R. 9,999; Poland 4,107; West Germany 3,780.
Unspecified	7,266	6,537	--	West Germany 4,968; Austria 1,497; Italy 50.
Steel, primary forms	90,537	80,502	--	Italy 28,098; Poland 14,555; India 13,412.
Semimanufactures:				
Bars, rods, angles, shapes, sections	635,591	517,811	--	Egypt 139,423; West Germany 54,248; Italy 38,815.
Universals, plates, sheets	182,833	123,915	--	China 44,738; Italy 18,783; West Germany 13,358.
Hoop and strip	8,437	10,134	--	Poland 6,622; Italy 3,095; West Germany 269.
Rails and accessories	14,031	15,804	--	India 6,206; Romania 5,280; Jordan 2,639.
Wire	59,680	31,070	--	Italy 19,446; Poland 3,118; U.S.S.R. 1,968.
Tubes, pipes, fittings	158,197	137,439	3,583	East Germany 25,208; U.S.S.R. 16,082; West Germany 15,105.
Castings and forgings, rough	7,221	8,319	264	Italy 2,340; Austria 1,766; West Germany 1,489.

See footnotes at end of table.

Table 2.—Yugoslavia: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Lead:				
Ore and concentrate	5,764	734	--	Bulgaria 384; Romania 350.
Oxides	5	6	--	U.S.S.R. 5; Iraq 1.
Metal including alloys:				
Unwrought	17,097	12,352	--	Czechoslovakia 9,810; Italy 1,669; U.S.S.R. 466.
Semimanufactures	48	74	--	Iraq 36; U.S.S.R. 31; Libya 6.
Magnesium: Metal including alloys:				
Scrap	63	36	--	All to West Germany.
Unwrought	3,044	2,789	215	West Germany 1,489; Belgium-Luxembourg 372.
Manganese:				
Ore and concentrate, metallurgical-grade	13,281	6,995	--	Italy 6,989; Romania 6.
Oxides	(2)	--		
Mercury 76-pound flasks	1,189	986	--	United Kingdom 812; Switzerland 116; Venezuela 58.
Nickel:				
Ore and concentrate	47	--		
Metal including alloys:				
Scrap	398	70	--	West Germany 42; Italy 28.
Unwrought	347	--		
Semimanufactures	167	1	--	Mainly to Egypt.
Platinum-group metals:				
Waste and sweepings value, thousands	$19	$5	--	All to West Germany.
Metals including alloys, unwrought and partly wrought do.	$137	--		
Silver:				
Ore and concentrate do.	--	(2)	(2)	
Waste and sweepings do.	$52	$6	--	All to West Germany.
Metal including alloys, unwrought and partly wrought thousand troy ounces	2,990	7,105	804	Italy 4,245; West Germany 1,061.
Tin: Metal including alloys:				
Unwrought	(2)	(2)	--	NA.
Semimanufactures	1	1	--	Mainly to U.S.S.R.
Titanium: Oxides	12,302	6,496	--	Spain 4,545; Italy 1,551; Austria 400.
Tungsten: Metal including alloys:				
Unwrought	9	--		
Semimanufactures	--	(2)	--	All to Czechoslovakia.
Zinc:				
Ore and concentrate	--	314	--	All to Bulgaria.
Oxides	2,085	1,886	--	West Germany 798; Romania 544; Austria 420.
Blue powder	5,828	5,861	--	Czechoslovakia 3,864; U.S.S.R. 987; Austria 848.
Metal including alloys:				
Scrap	465	(2)	--	All to Kuwait.
Unwrought	14,882	25,265	3,387	Czechoslovakia 11,740; East Germany 5,209.
Semimanufactures	r5,709	4,911	--	West Germany 3,069; Czechoslovakia 453; Hungary 414.
Other:				
Ashes and residues	761	1,427	--	Italy 926; Austria 501.
Base metals including alloys, all forms	--	387	385	Algeria 1; Austria 1.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	3	151	--	U.S.S.R. 140; Iraq 10; Czechoslovakia 1.
Artificial: Corundum	15,611	19,783	--	Italy 5,245; Romania 4,831; West Germany 3,340.
Grinding and polishing wheels and stones	3,743	3,398	242	West Germany 653; Italy 368.
Asbestos, crude	2,018	1,529	--	Albania 1,526; Czechoslovakia 3.
Barite and witherite	19,790	37,095	--	U.S.S.R. 14,600; Romania 11,295; Hungary 11,200.
Boron materials: Oxides and acids	--	(2)	--	All to Iraq.
Cement	1,263,103	862,457	1,476	Egypt 524,006; Italy 170,351; Sudan 37,500.
Chalk	(2)	--		

See footnotes at end of table.

Table 2.—Yugoslavia: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Clays, crude:				
Bentonite	292	79	--	West Germany 60; Albania 19.
Chamotte earth	2	3	--	Iraq 2; Czechoslovakia 1.
Fire clay	66	437	--	Bulgaria 373; Poland 40; Albania 20.
Kaolin	4	[2]	--	All to Italy.
Unspecified	4	112	--	Austria 96; Switzerland 10; Egypt 6.
Cryolite and chiolite	14	2	--	All to Malta.
Diatomite and other infusorial earth	1,504	655	--	Austria 654.
Feldspar	6,722	2,228	--	Hungary 925; Greece 706; Bulgaria 245.
Fertilizer materials:				
Crude, n.e.s	2	20	--	Mainly to United Kingdom.
Manufactured:				
Ammonia	64,706	46,748	--	Austria 10,482; West Germany 8,325; Hungary 1,016.
Nitrogenous	181,647	203,315	--	West Germany 56,177; Denmark 46,382; Morocco 38,484.
Phosphatic	95,809	89,834	--	Hungary 40,740; Czechoslovakia 37,255; Bulgaria 8,830.
Potassic	2	--	--	
Unspecified and mixed	526,553	472,496	--	Hungary 100,251; West Germany 91,215; U.S.S.R. 55,281.
Graphite, natural	24	[2]	--	NA.
Gypsum and plaster	8,826	10,556	--	Hungary 10,501; U.S.S.R. 30; Italy 20.
Lime	25,796	21,958	--	Hungary 13,921; Italy 4,449; Austria 2,455.
Magnesium compounds:				
Magnesite, crude	76	59	--	Italy 42; U.S.S.R. 17.
Oxides and hydroxides	r8,195	7,894	--	Albania 4,753; Italy 1,966; Poland 530.
Mica:				
Crude including splittings and waste	[2]	--		
Worked including agglomerated splittings	2	--		
Nitrates, crude	2,000	--		
Pigments, mineral: Iron oxides and hydroxides, processed	[2]	75	--	All to Italy.
Potassium salts, crude	--	[2]	--	All to Ethiopia.
Pyrite, unroasted	156,132	80,463	--	West Germany 79,685; Hungary 772; Malta 4.
Salt and brine	90	127	--	Hungary 50; Italy 44; Iraq 26.
Sodium compounds, n.e.s.: Carbonate, manufactured	15,228	17,179	--	Italy 9,631; Greece 3,796; Hungary 2,000.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	44,073	40,370	--	Italy 23,296; Czechoslovakia 12,117; Japan 2,109.
Worked	12,789	13,771	326	Austria 4,365; Italy 2,347; West Germany 1,857.
Dolomite, chiefly refractory-grade	192	107	--	Mainly to Austria.
Gravel and crushed rock	22,502	15,101	--	Czechoslovakia 4,079; U.S.S.R. 3,814; Italy 2,842.
Quartz and quartzite	14,432	15,333	--	West Germany 13,812; Spain 1,421; Poland 91.
Sand other than metal-bearing	22,859	20,328	--	Italy 9,396; Greece 8,676; Albania 1,333.
Sulfur:				
Elemental: Crude including native and byproduct	--	20	--	Mainly to United Kingdom.
Sulfuric acid	22,536	9,379	--	Italy 6,161; Austria 3,211; Iraq 3.
Talc, steatite, soapstone, pyrophyllite	54	91	--	Italy 83; Austria 8.
Other:				
Crude	4,108	3,656	--	Austria 2,900; West Germany 396; U.S.S.R. 225.
Slag and dross, not metal-bearing	2,614	22,363	--	Greece 13,636; Italy 4,429; Austria 4,199.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,658	5	--	Iraq 3; U.S.S.R. 2.
Carbon black	170	745	--	Mainly to East Germany.
Coal:				
Anthracite	22	1	--	All to West Germany.
Bituminous	4	--		
Briquets of anthracite and bituminous coal	--	2	--	All to Switzerland.
Lignite including briquets	504,450	409,672	--	Hungary 276,174; Austria 128,558; Italy 3,175.

See footnotes at end of table.

Table 2.—Yugoslavia: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coke and semicoke	152,132	114,887	--	Hungary 55,287; Austria 24,379; Belgium-Luxembourg 10,192.
Peat including briquets and litter	3,209	1,710	--	Italy 1,340; Iraq 350; Greece 20.
Petroleum refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	86	438	--	West Germany 269; Italy 135; Hungary 28.
Gasoline do	4,661	2,946	(2)	Italy 1,470; West Germany 865; Spain 154.
Mineral jelly and wax do	31	52	--	West Germany 27; Italy 17; Albania 3.
Kerosene and jet fuel do	164	204	17	United Kingdom 30; U.S.S.R. 29; Australia 19.
Distillate fuel oil do	359	242	(2)	West Germany 228; U.S.S.R. 7; Italy 1.
Lubricants do	858	1,053	--	Austria 673; United Kingdom 168; West Germany 86.
Residual fuel oil do	59	2,513	--	West Germany 1,988; Italy 272; Greece 50.
Bitumen and other residues do	1,319	818	--	Austria 436; Italy 272; Greece 50.
Bituminous mixtures do	2	4	--	U.S.S.R. 2; Algeria 1.
Petroleum coke do	97	67	--	Italy 44; West Germany 23.

[r]Revised. NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	(2)	77	--	U.S.S.R. 75; Austria 1; United Kingdom 1.
Alkaline-earth metals	168	148	(2)	France 122; Austria 18; Brazil 5.
Aluminum:				
Ore and concentrate	162,968	184,697	--	Guinea 121,037; Greece 25,046; China 16,794.
Oxides and hydroxides	118,366	151,460	15	Italy 69,919; Greece 43,874; Guinea 24,000.
Metal including alloys:				
Scrap	315	198	--	Mongolia 195; West Germany 3.
Unwrought	39,319	31,978	1	U.S.S.R. 31,423; Netherlands 450; United Kingdom 84.
Semimanufactures	14,063	12,285	23	U.S.S.R. 8,053; West Germany 1,528; Austria 858.
Antimony:				
Ore and concentrate	2,401	2,732	--	China 2,115; Morocco 320; Turkey 297.
Metal including alloys, all forms	234	1	--	All from Italy.
Arsenic:				
Oxides and acids	120	148	(2)	Austria 81; West Germany 45; France 20.
Metal including alloys, all forms	60	53	--	Sweden 42; West Germany 10; Austria 1.
Beryllium: Metal including alloys, all forms	(2)	(2)	(2)	Mainly from West Germany.
Bismuth: Metal including alloys, all forms	18	4	--	Belgium-Luxembourg 3; Switzerland 1.
Cadmium: Metal including alloys, all forms	(2)	1	--	All from West Germany.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Chromium:				
Ore and concentrate	281,066	286,965	--	Albania 152,114; U.S.S.R. 85,294; Turkey 47,538.
Oxides and hydroxides	667	1,007	--	U.S.S.R. 499; Netherlands 230; Poland 145.
Cobalt: Oxides and hydroxides	43	33	4	West Germany 12; United Kingdom 8; Netherlands 4.
Columbium and tantalum: Metal including alloys, all forms, tantalum	2	2	(2)	Mainly from West Germany.
Copper:				
Sulfate	2,826	1,100	--	U.S.S.R. 780; Poland 320.
Metal including alloys:				
Scrap	947	206	--	U.S.S.R. 200; Bulgaria 3; West Germany 2.
Unwrought	39,255	23,902	--	Zambia 7,991; Chile 5,968; Poland 3,280.
Semimanufactures	28,165	20,981	33	Poland 14,524; West Germany 1,795; U.S.S.R. 1,528.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	2,179,587	1,346,968	--	Brazil 361,719; U.S.S.R. 314,843; Peru 271,734.
Pyrite, roasted	1	1	--	All from West Germany.
Metal:				
Scrap	728,581	650,918	--	U.S.S.R. 560,291; Poland 44,986; Czechoslovakia 11,125.
Pig iron, cast iron, related materials	55,296	65,345	6	U.S.S.R. 33,275; Bulgaria 15,010; Turkey 11,932.
Ferroalloys:				
Ferrochromium	1,840	1,172	23	Bulgaria 347; West Germany 262; Austria 260.
Ferromanganese	1,563	1,714	--	West Germany 1,161; France 368; Austria 185.
Ferromolybdenum	697	989	--	Austria 746; West Germany 204; Italy 29.
Ferrosilicochromium	--	500	--	All from Poland.
Ferrosilicomanganese	43	(2)	--	All from Japan.
Ferrosilicon	1,074	838	--	West Germany 820; Austria 18.
Silicon metal	294	113	--	Italy 100; Austria 6; West Germany 5.
Unspecified	2,875	3,184	4	France 974; West Germany 973; Austria 676.
Steel, primary forms	762,279	815,634	--	U.S.S.R. 338,283; Czechoslovakia 255,896; Poland 71,896.
Semimanufactures:				
Bars, rods, angles, shapes, sections	186,903	199,253	7	Romania 61,406; Czechoslovakia 38,290; U.S.S.R. 21,794.
Universals, plates, sheets	431,323	506,085	11	Czechoslovakia 145,119; Austria 66,707; West Germany 56,628.
Hoop and strip	110,397	111,407	24	West Germany 32,465; Poland 28,023; Italy 9,889.
Rails and accessories	37,672	13,715	--	West Germany 5,482; Belgium-Luxembourg 2,415; Poland 1,939.
Wire	45,021	31,894	3	Czechoslovakia 7,849; West Germany 4,136; Poland 3,153.
Tubes, pipes, fittings	100,604	88,926	112	East Germany 23,333; West Germany 18,035; Italy 10,746.
Castings and forgings, rough	2,726	1,750	1	Czechoslovakia 821; West Germany 261; Romania 222.
Lead:				
Ore and concentrate	416	2,887	--	Italy 1,678; Greece 1,209.
Oxides	5,820	6,719	9	Austria 4,719; East Germany 1,510; Netherlands 358.
Metal including alloys:				
Scrap	960	1,859	--	Bulgaria 1,531; Switzerland 35; Canada 23.
Unwrought	9,520	13,439	--	Spain 4,000; Mexico 3,053; Bulgaria 2,355.
Semimanufactures	76	77	2	U.S.S.R. 41; West Germany 20; Italy 13.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Magnesium: Metal including alloys:				
Unwrought	(2)	(2)	--	All from Austria.
Semimanufactures	25	65	(2)	Norway 56; West Germany 7; France 2.
Manganese:				
Ore and concentrate, metallurgical-grade	140,249	132,548	--	Republic of South Africa 61,324; U.S.S.R. 31,293; Gabon 30,603.
Oxides	692	716	1	West Germany 369; France 151; Greece 95.
Mercury 76-pound flasks	232	290	--	Austria 145; West Germany 87; Spain 58.
Molybdenum: Metal including alloys:				
Unwrought	(2)	(2)	--	All from West Germany.
Semimanufactures	15	24	(2)	Austria 17; Hungary 4; United Kingdom 2.
Nickel:				
Matte and speiss	501	235	--	Australia 176; Cuba 56; West Germany 3.
Metal including alloys:				
Scrap	--	(2)	--	All from West Germany.
Unwrought	2,839	2,395	--	U.S.S.R. 1,797; Bulgaria 264; West Germany 228.
Semimanufactures	667	1,078	6	U.S.S.R. 526; West Germany 182; Italy 88.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$2,782	$2,332	$49	Czechoslovakia $999; U.S.S.R. $492; West Germany $400.
Silver:				
Waste and sweepings ---do---	--	(2)	--	All from West Germany.
Metal including alloys, unwrought and partly wrought thousand troy ounces	1,061	675	NA	Austria 450; West Germany 96; Italy 64.
Tin:				
Oxides	8	2	--	Japan 1; Netherlands 1.
Metal including alloys:				
Unwrought	1,387	1,565	--	Malaysia 1,199; Brazil 121; West Germany 119.
Semimanufactures	42	28	1	West Germany 25; Italy 1.
Titanium:				
Ore and concentrate	27,275	48,147	--	Australia 47,793; Sri Lanka 276; West Germany 54.
Oxides	1,080	919	--	West Germany 381; Czechoslovakia 220; Poland 175.
Tungsten:				
Ore and concentrate	2	--		
Metal including alloys:				
Unwrought	3	2	--	Bulgaria 1.
Semimanufactures	15	17	(2)	Switzerland 4; Czecholovakia 3; Hungary 2.
Zinc:				
Ore and concentrate	58,669	38,590	346	Czechoslovakia 14,167; Peru 10,071; Greece 8,714.
Oxides	3,226	1,970	--	Austria 839; Czechoslovakia 710; West Germany 265.
Blue powder	--	8	--	France 7.
Metal including alloys:				
Unwrought	39,281	18,773	--	Algeria 3,773; Bulgaria 3,537; Austria 2,993.
Semimanufactures	721	239	--	Bulgaria 188; Poland 41; Italy 7.
Other:				
Ores and concentrates	1,741	2,048	--	West Germany 1,342; Italy 406; Netherland 198.
Ashes and residues	1,400	1,707	--	Switzerland 1,339; Canada 289; Italy 79.
Base metals including alloys, all forms	588	415	12	Netherlands 162; West Germany 76; China 49.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural, corundum, emery, pumice, etc	294	334	--	Poland 222; Italy 95; Austria 9.
Artificial, corundum	1,988	1,914	14	Poland 759; Austria 484; Czechoslovakia 381.
Dust and powder of precious and semi-precious stones including diamond value, thousands	$1,502	$1,813	$6	Belgium-Luxembourg $555; U.S.S.R. $543; Switzerland $523.
Grinding and polishing wheels and stones	1,067	1,062	30	Austria 441; Italy 222; Poland 106.
Asbestos, crude	54,372	44,212	--	U.S.S.R. 30,066; Zimbabwe 6,180; Canada 3,918.
Barite and witherite	270	2,365	--	Italy 1,801; West Germany 252; United Kingdom 212.
Boron materials:				
Crude natural borates	33,687	34,453	8,742	Turkey 25,430; West Germany 158.
Oxides and acids	2,634	5,269	--	Italy 3,211; U.S.S.R. 657; Turkey 460.
Bromine	2	1	--	Mainly from Israel.
Cement	134,603	59,621	2,001	Hungary 24,215; Czechoslovakia 14,128; U.S.S.R. 10,125.
Chalk	3,967	4,775	--	France 2,370; Austria 1,877; Switzerland 400.
Clays, crude:				
Bentonite	15	51	--	West Germany 50; United Kingdom 1.
Chamotte earth	7,716	1,169	--	Czechoslovakia 549; France 415; United Kingdom 103.
Fire clay	36,643	50,376	587	Czechoslovakia 43,501; Spain 3,650; Poland 1,008.
Kaolin	83,136	93,096	925	Czechoslovakia 39,936; Greece 19,199; East Germany 13,883.
Unspecified	6,573	7,672	141	Poland 5,426; Czechoslovakia 1,797; Hungary 168.
Cryolite and chiolite	675	425	--	Denmark 424; United Kingdom 1.
Diamond:				
Gem, not set or strung value, thousands	$449	$1,603	--	Belgium-Luxembourg $1,411; United Kingdom $124; Ireland $65.
Industrial stones do	$1,426	$404	--	Belgium-Luxembourg $198; Switzerland $185; West Germany $20.
Diatomite and other infusorial earth	1,144	1,187	178	Italy 377; United Kingdom 305.
Feldspar, fluorspar, related materials:				
Feldspar	910	490	--	France 400; Finland 60; Czechoslovakia 20.
Fluorspar	9,298	9,223	--	China 5,576; France 1,304; East Germany 1,246.
Fertilizer materials:				
Crude, n.e.s	680	156	--	U.S.S.R. 100; France 56.
Manufactured:				
Ammonia	67,179	70,260	--	Hungary 44,822; Austria 6,626; U.S.S.R. 6,386.
Nitrogenous	462,003	357,685	--	Czechoslovakia 113,213; Hungary 100,397; U.S.S.R. 92,678.
Phosphatic	60,539	27,295	--	Romania 21,350; Tunisia 5,945.
Potassic	621,868	578,179	(2)	U.S.S.R. 293,321; East Germany 280,388; Austria 2,500.
Unspecified and mixed	131,529	79,264	42,966	Romania 26,991; Tunisia 7,990.
Graphite, natural	2,267	2,234	8	Czechoslovakia 1,391; West Germany 366; Austria 284.
Gypsum and plaster	24	62	4	West Germany 50; Italy 8.
Iodine	85	51	1	Japan 37; Chile 9; U.S.S.R. 3.
Lime	732	308	--	Bulgaria 285; United Kingdom 20.
Magnesium compounds:				
Magnesite, crude	27,533	5,244	--	All from Greece.
Oxides and hydroxides	r15,805	16,388	(2)	Greece 12,660; Italy 2,003; Norway 682.
Mica:				
Crude including splittings and waste	253	297	1	West Germany 171; India 67; France 39.
Worked including agglomerated splittings	132	112	--	Czechoslovakia 51; Austria 19; West Germany 18.
Nitrates, crude	--	100	--	All from East Germany.
Phosphates, crude	1,312,471	1,439,150	--	Jordan 584,580; Morocco 368,246; Togo 210,861.
Pigments, mineral: Iron oxides and hydroxides, processed	2,134	2,472	5	West Germany 861; Belgium-Luxembourg 525; U.S.S.R. 454.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Potassium salts, crude	2	1	--	All from West Germany.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$58	$104	--	West Germany $58; Switzerland $29; Australia $12.
Synthetic do.	$190	$219	--	Switzerland $97; West Germany $48; Austria $37.
Pyrite, unroasted	61,081	4,584	--	Albania 4,500; France 84.
Salt and brine	320,812	290,413	--	Romania 238,110; Egypt 15,830; Tunisia 15,377.
Sodium compounds, n.e.s.: Carbonate, manufactured	65,820	70,578	--	Romania 45,861; East Germany 8,450; Poland 5,706.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	312	1,898	--	U.S.S.R. 977; Czechoslovakia 396; France 387.
Worked	224	215	--	Albania 153; Italy 55; West Germany 6.
Dolomite, chiefly refractory-grade	514	185	--	West Germany 150; Norway 35.
Gravel and crushed rock	312	2,594	--	Hungary 1,424; Austria 891; Belgium-Luxembourg 116.
Limestone other than dimension	775	--	--	
Quartz and quartzite	17,740	8,046	20	Spain 6,115; Turkey 902; West Germany 890.
Sand other than metal-bearing	56,786	72,832	653	Hungary 26,995; Czechoslovakia 21,674; West Germany 20,031.
Sulfur:				
Elemental:				
Crude including native and by-product	162,726	171,756	94	Poland 136,986; Canada 17,845; Saudi Arabia 9,670.
Colloidal, precipitated, sublimed	584	498	--	Poland 244; West Germany 151; Hungary 59.
Dioxide	200	350	--	All from Italy.
Sulfuric acid	58,672	11,866	--	Hungary 9,572; Czechoslovakia 1,731; Austria 333.
Talc, steatite, soapstone, pyrophyllite	4,378	4,856	--	Austria 1,406; West Germany 1,258; Belgium-Luxembourg 966.
Other:				
Crude	13,317	14,768	24	Hungary 10,898; U.S.S.R. 2,196; Austria 537.
Slag and dross, not metal-bearing	11,808	5,207	--	Canada 4,999; Italy 191; West Germany 17.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	536	76	10	Albania 59; West Germany 4.
Carbon black	27,751	25,784	34	Italy 17,490; Mexico 3,465; France 1,819.
Coal:				
Anthracite thousand tons	247	211	--	All from U.S.S.R.
Bituminous do.	4,033	3,813	584	U.S.S.R. 2,259; Poland 510.
Briquets of anthracite and bituminous coal do.	--	1	--	All from Poland.
Lignite including briquets do.	162	186	--	U.S.S.R. 91; East Germany 79; Czechoslovakia 15.
Coke and semicoke do.	35	41	12	Turkey 16; Italy 7.
Gas, natural, gaseous million cubic feet	129,933	130,553	--	All from U.S.S.R.
Peat including briquets and litter	7,445	9,048	--	U.S.S.R. 7,919; Hungary 1,129.
Petroleum:				
Crude thousand 42-gallon barrels	64,696	80,820	--	Iraq 39,681; U.S.S.R. 15,471; Libya 10,081.
Refinery products:				
Liquefied petroleum gas do.	862	582	--	Bulgaria 434; Hungary 101; United Kingdom 14.
Gasoline do.	150	574	(2)	United Kingdom 264; Turkey 170; Hungary 89.
Mineral jelly and wax do.	22	22	(2)	Italy 7; West Germany 6; Netherlands 2.
Kerosene and jet fuel do.	835	787	--	Italy 581; Hungary 142; United Kingdom 41.
Distillate fuel oil do.	88	1,164	4	U.S.S.R. 473; Hungary 293; United Kingdom 149.
Lubricants do.	589	711	1	Italy 167; Hungary 108; Bulgaria 86.
Residual fuel oil do.	9,096	5,351	--	U.S.S.R. 2,993; Italy 989; France 346.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products —Continued				
Bitumen and other residues thousand 42-gallon barrels	1	5	--	Albania 4; Netherlands 1.
Bituminous mixtures do	1	1	(2)	Mainly from Italy.
Petroleum coke do	562	757	386	West Germany 65; U.S.S.R. 49.

[r]Revised. NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—In 1987, bauxite production declined slightly compared with that of 1986. The Nisic mines near Titograd produced approximately one-third of the total output of bauxite for the year. However, underground operations at Nisic continued to increase, and mining conditions worsened during the year. About 25% of the bauxite produced at Nisic in 1987 was exported. The balance of the country's bauxite was produced largely by open pit operations at Vlasenica. Yugoslavia's production of bauxite in 1987 amounted to 3.6% of the total world output and 20% of the combined output of Europe and the U.S.S.R. In keeping with the program to introduce new technology to modernize aluminum production, the Boris Kidric alumina-refining and aluminum-smelting enterprise put on-stream a new 21,000-ton-per-year anode plant and planned the completion of a new electrolysis plant with 72 electrolytic units in 1988. When completed, the new electrolysis plant would add 35,000 tons of aluminum-smelting capacity to the Boris Kidric enterprise. At yearend, the Mostar aluminum enterprise began preparations for the construction of a fabricating facility for drawn aluminum and aluminum rods and tubes at Citluk. When fully operational, the plant would process 2,250 tons of metal per year and allocate about 60% of its production for export.

Antimony.—Although the production of antimony declined by more than 30% in 1987 compared with that in 1985, Yugoslavia remained a major European producer. The small-sized vein ore deposits in the western part of Serbia were mined by the Zajaca mining and metallurgical complex at the Brasina, Dolici, Kik, Rujevac, Stira, and Zavorje Mines. The ore was mined entirely underground, largely by means of roof plate caving and hanging wall caving. The discovery of substantial antimony deposits in the early 1980's at Vinogradi near Rujevac as well as other smaller deposits in southern Serbia and Macedonia added more than 1 million tons of ore reserves to this industry. In 1987, Yugoslavia's monthly average exports of unwrought antimony to the United States increased by 24% compared with those from 1981 to 1985.

Copper.—Copper ore was mined and processed at the Bor, Bucim, and Majdanpek mining and beneficiation complexes, which in 1987 accounted for 43%, 13%, and 44%, respectively, of Yugoslavia's copper output. The average grade of ore at Bor ranged from 0.47% to 0.90%. Ore grades at Bucim and Majdanpek were 0.27% and 0.56%, respectively. Ore reserves were reported at several hundred million tons, and included associated gold, iron, molybdenum, rare metals, and silver. Open pit mining accounted for about 70% of total output. Underground mining was carried out only at Bor, where both mining methods were used.

At yearend, Yugoslavia announced plans to modernize a lacquered copper factory at Bor. The project was to be completed by 1990 at a cost of $10 million, and would raise production from 16,000 to 18,000 tons per year. Most of the production would be exported.

Gold.—A deposit containing pebbles bearing gold and rare metals was discovered in eastern Serbia near Bosilegrad. The pebble-bearing strata were determined to be 40 meters thick and 5 kilometers long. The strata were estimated at 200 million cubic meters. Analysis of a 150-ton ore sample

reportedly indicated that mining would be feasible. At yearend, Yugoslavia announced plans to reopen the Blagoev Kamen gold mine in the Bor mining district. The mine, closed since 1964, was reported to have an average ore grade of 8 grams of gold per ton. Additional geological work would be conducted to determine the extent of ore reserves.

Iron and Steel.—At the end of December, the Serbian Government approved a recovery program for the Smeredevo iron and steel works, the country's largest unprofitable business. The steel company's losses for 1987 amounted to about $90 million. In addition, the company owed $1.5 billion to foreign banks and $150 million to Yugoslav banks. The recovery program and the development of the next stage of Smeredevo's steelmaking operations would cost about $1 billion, which would be provided jointly by the Serbian Government, the Investbanka Bank of Belgrade, and the company's business partners.

The Government indicated that Smeredevo's planned output of more than 1 million tons of steel by 1993 would enable the company to operate profitably and to begin paying its debts. A declaration of bankruptcy would result, among other things, in direct costs of $1.6 billion and a sizable unpaid foreign debt, as well as a loss through 1993 of steel products worth $3 billion, which would then have to be imported. Bankruptcy would also have a major impact on the country's unemployment. At yearend, the Smeredevo iron and steel works planned to increase cold-rolled sheet output from 150,000 tons in 1987 to 650,000 by 1990.

In October, the Skopje iron and steel enterprise ceased operations owing to rising costs of electricity and transportation. The Sisak iron and steel works in Croatia announced plans to construct a new mill to produce 200,000 tons per year of seamless tubes. Sisak also commissioned a new 550,000-ton-per-year iron ore concentrator that would allow the company to increase output by 25%.

In 1987, the European Economic Community (EEC) Commission began an inquiry on allegations of dumping of cold-rolled steel on the European market by Yugoslavia. Complaints were made that Yugoslavia's steel exports were undercutting EEC prices by between 16% and 44%, while exports of Yugoslav steel rose by 433%. Following the inquiry, the Commission imposed tariffs on Yugoslavia's hot- and cold-rolled plate.

Lead and Zinc.—The Trepca lead and zinc mining, smelting, and refining complex in Kosovo, the country's largest lead and zinc producer, incurred substantial financial losses. According to Government authorities, obsolescent equipment, a decline in ore quality, and poor management contributed to the company's financial downturn. Trepca's plans for 1988 called for a reduction in the output of electrolytic zinc by 5,000 tons and an increase in the production of refined lead by 20,000 tons. The Zletovo lead and zinc smelter at Titov Veles fulfilled its plan for 1987. The combined output of lead and zinc at the smelter by yearend amounted to 82,000 tons.

INDUSTRIAL MINERALS

Calcite.—Construction of Yugoslavia's first calcite mine at Gadzin Han in Serbia started late in the year. Operational startup was scheduled for the second half of 1988, and production would amount to about 35,000 tons per year from a reserve base estimated at 1.5 million tons. The calcite was determined to be of a very high purity, containing 99.8% calcium carbonate, and would be used directly by the country's pharmaceutical and cosmetics industries.

Quartz.—The Bor copper-mining and metallurgical complex planned to use some of its capacity to produce extra-pure glass, ceramics, and high-temperature superconductors based on quartz sand. Raw materials would be obtained at a new quartz sand mine near the Bor complex with reserves estimated at 20 million tons. The project cost was to be about $20 million.

MINERAL FUELS

In November, Yugoslavia added four new electric power stations that raised the country's electric-power-generating capacity to 20,546,300 megawatts. The coal-fired Drmno-1 and Kakanj-5 plants had the largest installed capacity of the four plants. The two smaller plants were hydrogenerated. A spokesperson for the Federal Energy Commission indicated that the country could satisfy its demands for power from conventional, nonnuclear sources. Yugoslavia's lignite reserves were sufficient for 250 years, those of brown and bituminous coal, for 50 and 40 years, respectively. By 1997, coal consumption was planned to be about 130 million tons per year. To meet this target, facilities under construction would add 44.4 million tons of coal for domestic consumption.

Coal.—Coal production for 1988 was

planned at 77.2 million tons. To meet this target, new facilities would be put into operation while existing ones would be expanded. These were to include the startup of the Globnuko, Koromacno, and the Vojakovacki Kloster Mines in western Yugoslavia, and the Drmno and Zabela-Kosa Mines in the eastern part of the country. Mine expansion would be completed at the Kolubara Coalfield near Belgrade, and at Tuzla and Zenica in central Yugoslavia and in Kosovo. In 1987, lignite production at the Kolubara-Lazarevac Field reached 26 million tons, about 1 million tons in excess of the plan for the year. The Kolubara-Lazarevac Field accounted for about 36% of the country's total coal production.

Petroleum and Natural Gas.—In 1987, the Naftagas enterprise of Novi Sad conducted seismic and geophysical explorations at the oilfields near Vrsac. A total of $150 million was allocated for petroleum and natural gas exploration in this region through 1990. In other developments, the Ina-Naftaplin enterprise in Zagreb invested $27.2 million, or 77% of the enterprise's planned investment for 1987 for petroleum and gas pipeline construction and related facilities.

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[1]Foreign mineral specialist, Division of International Minerals.

The Mineral Industry of Zaire

By George A. Morgan[1]

In 1987, production of most mineral commodities remained relatively unchanged from 1986 as La Générale des Carrières et des Mines du Zaire (Gécamines), the major producer, continued nearly full-capacity operation of its mines and plants. In the last quarter of the year, emphasis was placed by Gécamines on increased shipments of copper via the country's already heavily burdened railroad system owing to price increases for that metal.

The gross domestic product was about $5 billion,[2] up about 2.5% over the previous year, and per capita income was estimated at $170. Owing to a decline in export receipts, Zaire had less money to pay for imports, most of which were from Europe where prices were in currencies that had appreciated against the U.S. dollar. Deficit spending by the Government because of the reductions in foreign exchange and tax receipts led to an inflation rate of 100%.

Zaire became a member of the Multilateral Investment Guarantee Agency (MIGA), which would insure new foreign investment in Zaire from currency manipulation, expropriation, and civil unrest. Investors in the United States would be eligible for such insurance following approval of their participation in MIGA by the U.S. Congress.

PRODUCTION AND TRADE

Total exports were valued at $1.75 billion, a decline of $94 million from 1986. Total imports were valued at $1.62 billion, an increase of $93 million over that of 1986.

United States imports of mineral and mineral products from Zaire were about $295 million, compared with $321 million in total imports from Zaire. Those imports consisted primarily of crude petroleum, $131 million; cobalt, $65 million; diamond, $49 million; copper, $34 million; and zinc, $13 million. U.S. exports to Zaire of mineral-based materials were about $0.83 million, compared with $103 million in total U.S. exports to Zaire, and consisted primarily of iron and steel. U.S. bilateral aid with Zaire totaled $67.1 million, of which $61.8 million was economic aid.

An investment program of $52 million was instituted for upgrading the most heavily traveled rail system in Zaire, the 1,820-kilometer line between Sakania on the border with Zambia, and Ilebo, the barge transfer port on the Kasai River. The Société Nationale des Chemins de Fer Zaire (SNCZ) had responsibility for the upgrading and maintenance program, financing of which was by the International Bank for Reconstruction and Development (World Bank), the African Development Bank (ADB), Belgium, and France. Among the goals of the program were to increase train speed, reduce the number of stops, and increase the use of containers in order to improve overall security. It took an average of 53 days for shipments of copper to move from plants in the Shaba Region to Matadi, the country's only major export-import terminal on the Atlantic Ocean coast. SNCZ planned to spend $2 million on the purchase of 1,250 used containers to improve security.

A proposal by Southern African Development Coordination Conference to rehabilitate the Benguela Railroad at a cost of $575

million was stymied when Zaire declined to provide troops, along with Zambia and Angola, to protect the route. The Benguela Railroad had been a major transport route for central Africa until late 1975 when the civil war in Angola forced its closure. The viability of several important mining operations in Zaire was based upon the efficient operation of the Benguela Railroad. Export traffic from Zaire was primarily through the southern route through Zambia, Zimbabwe, and the Republic of South Africa. Returning railcars brought manufactured items, food, coke, and sulfur. The SNCZ currently has 1,900 railcars on lease.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Cadmium, smelter	308	318	296	364	300
Cobalt:					
Concentrate, Co content	24,767	25,943	29,200	r e31,000	29,000
Refined	5,360	9,075	10,791	14,500	2,11,073
Columbium-tantalum concentrate:					
Gross weight kilograms	51,000	100,000	147,000	r e50,000	50,000
Cb content[e] do	13,800	27,000	40,000	13,000	13,000
Ta content[e] do	14,300	28,000	41,200	14,000	14,000
Copper:					
Concentrate, Cu content	536,500	562,000	557,900	563,000	564,000
Blister and leach cathodes	479,100	480,600	486,800	498,100	500,000
Refined	227,231	224,774	221,400	218,000	220,000
Gold troy ounces	192,930	117,115	63,022	167,827	2,140,561
Monazite concentrate, gross weight	15	2	--	7	2,97
Silver thousand troy ounces	1,288	1,225	1,516	e1,500	1,400
Tin:					
Mine output, Sn content	2,163	2,708	3,100	2,650	2,2,378
Smelter, primary	201	170	85	56	--
Tungsten, mine output, W content	44	30	18	27	21
Zinc:					
Mine output, Zn content	101,500	101,900	105,600	126,700	125,000
Concentrate, Zn content	76,215	74,836	77,457	81,300	81,300
Metal, primary, electrolytic	r62,535	r66,087	r64,046	63,900	2,54,878
INDUSTRIAL MINERALS					
Cement, hydraulic thousand tons	513	r534	444	r e400	400
Diamond:					
Gem[e] thousand carats	3,355	5,169	4,032	4,661	3,885
Industrial[e] do	8,627	13,290	16,127	18,643	15,540
Total do	11,982	18,459	20,159	23,304	2,19,425
Lime	106,993	109,856	115,365	136,400	137,000
Stone, crushed thousand tons	387	348	e350	e350	350
Sulfur:					
Byproduct of metallurgy, S content of sulfuric acid from sphalerite[e]	36,000	37,000	36,000	38,500	36,000
Sulfuric acid, gross weight[3]	159,864	152,800	169,000	146,400	150,000
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous thousand tons	111	121	121	r e110	110
Petroleum:					
Crude thousand 42-gallon barrels	9,234	11,698	12,226	11,857	11,420
Refinery products:					
Gasoline do	62	258	18	--	250
Kerosene and jet fuel do	42	240	--	--	250
Distillate fuel oil do	105	422	--	--	450
Residual fuel oil do	101	364	--	--	370
Refinery fuel and losses do	34	67	19	--	80
Total do	344	1,351	37	--	1,400

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through July 14, 1988.
[2]Reported figure.
[3]Includes acid produced from imported sulfur.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys, scrap	16	--		
Antimony: Ore and concentrate	449	--		
Cadmium: Metal including alloys, all forms	[2]224	293	--	United Kingdom 105; France 70; Belgium-Luxembourg 44.
Cobalt:				
Oxides and hydroxides	--	583	583	
Metal including alloys, all forms	[2]9,298	5,082	315	Japan 2,016; West Gemany 1,633; United Kingdom 593.
Columbium and tantalum: Ore and concentrate	26	39	39	
Copper:				
Ore and concentrate	[2]59,060	NA		
Matte and speiss including cement copper	50	--		
Metal including alloys:				
Scrap	NA	140	--	West Germany 104; Switzerland 19.
Unwrought	NA	437,502	36,002	Belgium-Luxembourg 251,759; Italy 23,904.
Semimanufactures	NA	280	--	All to Belgium-Luxembourg.
All forms	[2]463,913	NA		
Gold: Metal including alloys, unwrought and partly wrought -- troy, ounces	965	18,210	--	Belgium-Luxembourg 18,104; West Germany 106.
Iron and steel: Metal:				
Ferroalloys:				
Ferromanganese	--	43	--	All to West Germany.
Ferrosilicon	--	20	--	Do.
Unspecified	25	20	--	Do.
Semimanufactures:				
Universals, plates, sheets	276	25	--	All to Italy.
Castings and forgings, rough	24	--		
Lead: Ash and residue containing lead	--	21	--	All to Belgium-Luxembourg.
Manganese: Ore and concentrate, metallurgical-grade	25,498	797	--	All to West Germany.
Nickel: Metal including alloys:				
Unwrought	22	71	20	Republic of Korea 51.
Semimanufactures	--	190	--	All to Taiwan.
Silver:				
Ore and concentrate[3] value, thousands	$1,680	$124	--	United Kingdom $85; Spain $39.
Metal including alloys, unwrought and partly wrought -- do	--	$1	--	All to Belgium-Luxembourg.
Tin:				
Ore and concentrate	[2]5,095	1,315	--	Spain 1,014; Netherlands 169.
Metal including alloys:				
Unwrought	15	1,034	5	Republic of Korea 999; Netherlands 30.
Semimanufactures	--	10	--	All to West Germany.
Tungsten:				
Ore and concentrate	33	41	--	Do.
Metal including alloys, all forms	[2]64	NA		
Zinc:				
Ore and concentrate	5,260	--		
Metal including alloys, unwrought	[2]70,700	26,815	15,974	Taiwan 4,973; West Germny 1,493.
Other:				
Ores and concentrates	49	--		
Ashes and residues	373	106	--	West Germany 68; France 38.
Base metals including alloys, all forms	1,818	2,505	--	West Germany 1,835; France 381.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc value, thousands	$3	$20	$20	
Dust and powder of precious and semiprecious stones including diamond do	[r]$146	$134	$26	France $83; West Germany $14.
Grinding and polishing wheels and stones do	$1,428	--		
Cement	[2]85,208	NA		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Diamond:				
Gem, not set or strung thousand carats	[4]6,479	[4]10,670	586	Belgium-Luxembourg 10,048.
Industrial stones do	[4]4,546	[4]3,090	198	Belgium-Luxembourg 2,752; Spain 108.
Dust and powder do	1,511	1,342	394	Japan 948.
Diatomite and other infusorial earth	15	--		
Meerschaum, amber, jet	1	--		
Precious and semiprecious stones other than diamond:				
Natural value, thousand	$452	$882	$7	Hong Kong $589; West Germany $117.
Synthetic do	$7	--		
Stone, sand and gravel: Dimension stone, crude and partly worked	([5])	195	--	All to Italy.
Other: Crude	2	--		
MINERAL FUELS AND RELATED MATERIALS				
Petroleum:				
Crude thousand 42-gallon barrels	12,561	11,637	8,382	Belgium-Luxembourg 2,296; Netherlands 640.
Refinery products:				
Mineral jelly and wax 42-gallon barrels	32	--		
Residual fuel oil do	NA	96	89	Belgium-Luxembourg 7.

[r]Revised. NA Not available.

[1]Table prepared by Virginia A. Woodson. Owing to a lack of available official trade data published by Zaire, this table should not be taken as a complete presentation of this country's mineral exports. These data have been compiled from trade statistics of individual trading partners unless otherwise specified.

[2]Conjoncture Economique (printed in Belgium).

[3]May include waste and sweepings and other precious metals.

[4]Incomplete total; excludes imports expressed in value only.

[5]Unreported quantity valued at $44,000.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	24	143	--	United Kingdom 140.
Metal including alloys:				
Unwrought	1	--		
Semimanufactures	1,137	984	1	Netherlands 358; Belgium-Luxembourg 208; Canada 196.
Copper: Metal including alloys, semimanufactures	99	261	--	Taiwan 210; Belgium-Luxembourg 33.
Gold: Metal including alloys, unwrought and partly wrought value, thousands	--	$4	--	All from Belgium-Luxembourg.
Iron and steel: Metal:				
Scrap	10	--		
Pig iron, cast iron, related materials	41	2	--	All from France.
Ferroalloys:				
Ferromanganese	10	1	--	Do.
Ferrosilicon	--	5	--	All from Belgium-Luxembourg.
Unspecified	39	42	--	France 37; Belgium-Luxembourg 5.
Steel, primary forms	3	--		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel: Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections	11,712	7,435	1	Belgium-Luxembourg 5,437; Italy 762; France 475.
Universals, plates, sheets	18,285	13,807	--	Japan 7,809; Belgium-Luxembourg 2,581; West Germany 1,958.
Hoop and strip	1,875	1,228	--	Belgium-Luxembourg 561; West Germany 549.
Rails and accessories	1,906	10,491	--	Belgium-Luxembourg 10,479.
Wire	865	570	--	Belgium-Luxembourg 507; Italy 30.
Tubes, pipes, fittings	14,222	5,018	13	West Germany 1,284; Belgium-Luxembourg 1,191; Japan 997.
Castings and forgings, rough	3,120	1,182	--	Belgium-Luxembourg 519; Italy 500.
Lead:				
Oxides	37	18	--	Belgium-Luxembourg 14; France 4.
Metal including alloys:				
Unwrought	1,154	118	--	Belgium-Luxembourg 93; West Germany 21.
Semimanufactures	2	5	--	All from Belgium-Luxembourg.
Manganese: Ore and concentrate, metallurgical-grade	4	--		
Nickel: Metal including alloys:				
Unwrought	4	--		
Semimanufactures	1	3	--	Belgium-Luxembourg 2; Switzerland 1.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$29	$13	--	United Kingdom $7; France $3.
Silver: Metal including alloys, unwrought and partly wrought do	$1,439	$542	--	Belgium-Luxembourg $299; Yugoslavia $221.
Tin: Metal including alloys:				
Unwrought	1	5	--	Belgium-Luxembourg 2; United Kingdom 2.
Semimanufactures	--	2	--	All from Belgium-Luxembourg.
Titanium:				
Ore and concentrate	5	20	--	All from Netherlands.
Oxides	86	48	--	Belgium-Luxembourg 25; France 20.
Zinc:				
Oxides	7	8	--	All from France.
Metal including alloys, semimanufactures	6	12	--	Belgium-Luxembourg 4; France 4; Italy 4.
Other: Ores and concentrates	20	25	--	Netherlands 20; Italy 5.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	--	7	--	Hong Kong 5; Belgium-Luxembourg 2.
Artificial:				
Corundum	4	--		
Silicon carbide value, thousands	$3	--		
Grinding and polishing wheels and stones	90	81	--	Italy 40; Beglium-Luxembourg 31.
Asbestos, crude	210	198	--	Canada 174; Italy 24.
Barite and witherite	1,305	400	--	All from Netherlands.
Cement	3,614	1,222	--	Belgium-Luxembourg 1,146; Italy 30.
Chalk	164	60	--	All from Belgium-Luxembourg.
Clays, crude:				
Bentonite	210	23	--	All from Netherlands.
Chamotte earth	--	180	--	All from Italy.
Kaolin	7	18	--	Belgium-Luxembourg 9; Italy 9.
Unspecified	59	208	--	Italy 191; Japan 17.
Cryolite and chiolite	1	--		
Diamond:				
Gem, not set or strung carats	(2)	14,841	--	All from Belgium-Luxembourg.
Industrial stones value, thousands	$52	--		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Diatomite and other infusorial earth	911	355	--	France 348.
Feldspar, fluospar, related materials	15	--		
Fertilizer materials:				
Crude, n.e.s.	301	13	--	All from Belgium-Luxembourg.
Manufactured:				
Ammonia	52	89	--	Netherlands 41; Belgium-Luxembourg 36.
Nitrogenous	11,308	5,906	--	Japan 1,869; West Germany 3,032.
Phosphatic	857	228	--	All from Belgium-Luxembourg.
Potassic	101	812	--	West Germany 613; Belgium-Luxembourg 199.
Unspecified and mixed	7,030	8,517	--	Japan 4,155; Belgium-Luxembourg 3,542.
Graphite, natural	--	3	--	All from Belgium-Luxembourg.
Gypsum and plaster	178	5,902	--	Spain 5,600; France 225.
Lime	1,508	1,817	--	Belgium-Luxembourg 1,783; United Kingdom 30.
Magnesium compounds:				
Magnesite, crude	(2)	8	--	Belgium-Luxembourg 7; Italy 1.
Other	441	137	--	West Germany 100; Belgium-Luxembourg 37.
Mica: Crude including splittings and waste	4	3	--	All from Netherlands.
Phosphates, crude	50	4	--	All from Belgium-Luxembourg.
Pigments, mineral: Iron oxides and hydroxides, processed	18	8	--	Do.
Precious and semiprecious stones other than diamond: Natural value, thousands	$48	$3	--	Do.
Salt and brine	145	130	--	Belgium-Luxembourg 113; United Kingdom 10.
Sodium compounds, n.e.s.: Carbonate, manufactured	1,889	2,208	--	West Germany 1,200; France 1,002.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	91	83	--	Portugal 67; Italy 15.
Worked	714	442	--	Italy 216; Portugal 157.
Gravel and crushed rock	381	28	--	All from Italy.
Quartz and quartzite	--	27	--	All from Netherlands.
Sand other than metal-bearing	485	35	--	Belgium-Luxembourg 25; France 10.
Sulfur:				
Elemental:				
Crude including native and by-product	283	117	--	West Germany 93; Belgium-Luxembourg 24.
Colloidal, precipated, sublimed	3	--		
Sulfuric acid	180	346	64	Belgium-Luxembourg 170; Netherlands 103.
Talc, steatite, soapstone, pyrophyllite	406	289	--	France 270; Spain 7.
Other:				
Crude	447	140	--	West Germany 100; Belgium-Luxembourg 39.
Slag and dross, not metal-bearing	65	180	--	All from Belgium-Luxembourg.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	4	180	164	Belgium-Luxembourg 12.
Carbon black	680	23	--	United Kingdom 22.
Coal:				
Anthracite and bituminous	12	--		
Briquets of anthracite and bituminous coal	126	--		
Lignite including briquets	10	--		
Coke and semicoke	1,002	2	--	All from Belgium-Luxembourg.
Peat including briquets and litter	9	24	--	Do.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude_ thousand 42-gallon barrels_ _	730	NA		
Refinery products:				
Gasoline, motor _ _ _ _ _ _do_ _ _ _	170	13	_ _	Netherlands 7; Belgium-Luxembourg 6.
Mineral jelly and wax _ _do_ _ _ _	2	4	_ _	France 1; West Germany 1.
Kerosene and jet fuel_ _ _do_ _ _ _	24	545	_ _	All from Spain.
Distillate fuel oil _ _ _ _ _do_ _ _ _	26	111	_ _	Spain 108.
Lubricants _ _ _ _ _ _ _ _ _do_ _ _ _	32	20	(3)	Belgium-Luxembourg 13; France 2.
Residual fuel oil_ _ _ _ _ _do_ _ _ _	4437	1	_ _	All from Spain.
Asphalt _ _ _ _ _ _ _ _ _ _ _do_ _ _ _	(5)	_ _		
Bitumen and other residues do_ _ _ _	16	6	_ _	Spain 4; Belgium-Luxembourg 2.
Bituminous mixtures_ _ _do_ _ _ _	23	4	_ _	Belgium-Luxembourg 2; Spain 1.
Petroleum coke _ _ _ _ _ _do_ _ _ _	(5)	_ _		

NA Not available.

[1]Table prepared by Virginia A. Woodson. Owing to a lack of available official trade data published by Zaire, this table should not be taken as a complete presentation of this country's mineral imports. These data have been compiled from trade statistics of individual trading partners unless otherwise specified.

[2]Unreported quantity valued at $433,000.

[3]Unreported quantity valued at $50,000.

[4]Conjoncture Economique (printed in Belgium).

[5]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Cobalt.—Zaire was the largest producer of cobalt in the world, with about 50% of total production, all as a byproduct of copper. Exports in 1987 were estimated at about 10,000 tons, compared with just over 11,000 tons produced. Kolwezi and Likasi were the main cobalt production centers. Average ore grade was about 0.35% cobalt. Based on the mining and milling of more than 17 million tons of ore annually, approximately 30,000 tons of cobalt was contained in concentrates produced from this ore. Because of the nature of the ore and emphasis upon the primary product, copper, recovery of cobalt has averaged only about 35%.

Copper.—Gécamines, with a labor force of about 36,000, was the largest company in Zaire, and Zaire was the fifth largest producer of mine copper in the world. About 80% of copper exports have been to Europe, with processing and refining of blister copper being done in Belgium. Gécamines mining and mineral processing facilities were in the Shaba Region near the Zambian border and were spread through the towns of Kolwezi, Likasi, Lubumbashi. About 80% of copper production was from the western group of mines, with continued development of the Kov Mine and expansion of the Dikuluwe Mine, both open pits. Trolley-assist equipment for electric haulage trucks was installed at the Dikuluwe Mine and also was being installed at the Kov Mine to take advantage of the abundant electric power, to speed the transport of ore, and to lessen the consumption of diesel fuel in the mining sector. Output from the Kov Mine was behind target, and Gécamines continued to be faced with pressure to supply ore to the concentrators. However, copper oxide ore has graded up to 12% copper, with the grade of ore to the main mills averaging 4% copper. Gécamines let a contract to a South African firm for five new 170-ton off-highway trucks and six used trucks, valued at $10 million. The trucks would be used at Kolwezi.

A 5-year program for a new plant and equipment costing about $750 million was planned. Gécamines self-financing would provide for 59% of the total cost, and the remainder would be supplied by the World Bank, 16%; the ADB, 9%; the European Investment Bank, 7%; and others, including bilateral donors, 7%. A major portion of these funds would be spent on expanding copper-refining capacity at Luilu. The use of column flotation was expected to yield

about 25,000 tons of copper annually. Despite the modernization of facilities, costs were expected to increase as the stripping ratio of waste to ore increases with the deepening of the open pit mines.

Gécamines once again became the sole producer of primary copper in Zaire in April, when the Société de Développement Industriel et Minière du Zaire (Sodimiza), 100% Government owned, was incorporated into Gécamines. Sodimiza's copper concentrates were being shipped to the Mufulira smelter and refinery in Zambia for processing, but they probably would be smelted at Lubumbashi once the smelter there was refurbished. Output from Sodimiza was about 33,000 tons of copper contained in concentrates.

Gécamines undertook feasibility studies on open pit mining of the Tenke-Fungurume deposit, about 75 kilometers east of Kolwezi. Location of milling facilities has not been indicated, although some processing may be done in the central group to maintain employment in that region.

Gold.—Work on developing the D7 Kanga gold deposit of Office des Mines d'Or de Kilo-Moto (Okimo) was to proceed with construction of a $1.5 million access road to the site. Funds for the road were provided by the ADB, although Okimo had yet to sign the contract for work to begin. A geological survey and a feasibility study were to be completed before Andrade Gutierrez of Brazil would commence a search for additional funding. Total estimated cost was about $110 million, and production was to be about 200,000 troy ounces of gold per year.

Manganese.—The sale of 150,000 tons of stockpiled manganese to Marc Rich, a commodity trader, was blocked by the Government following charges of mismanagement of Entreprise Minière de Kisenge Manganese (EMK) finances. EMK was a Government-owned company responsible for the manganese mines and plant near Kisenge. Earlier sales of 216,000 tons hinged on an unsuccessful transport scheme to move the ore via Sakania on the border with Zambia. Transport costs were too high, particularly in view of the competition with copper for available transport services.

INDUSTRIAL MINERALS

Diamond.—The Société Minière de Bakwanga (MIBA) planned to expand annual production of diamonds during the 1987-91 5-year plan, with output reaching 9.5 million carats in 1991, compared with 8.2 million carats in 1987. The increase was expected primarily from higher production from dredging operations. Recovery of diamond from reprocessed tailings declined. MIBA was the only licensed producer of diamond, operating its own concession area. The remaining output, more than 11 million carats, was by individuals and family operations who did not require licenses or permits to exploit diamond in nonconcession areas of MIBA.

Sulfur.—Sulfur was produced as a by-product of copper and cobalt mining, and was used locally for the production of sulfuric acid for the mining sector. Sulfur and sulfuric acid were also imported.

MINERAL FUELS

Electricity for mining operations in the Shaba Region and for Gécamines in particular was based on hydropower, both from local power stations and via the 1,800-kilometer Inga-Shaba power line from power stations on the Zaire River west of Kinshasa. The Inga-Shaba line had not been entirely reliable, although it supplied about 40% of the Shaba Region's power needs.

An agreement was ratified with the Central African Republic for the construction of a dam at Mobayi-Mbongo on the Ubangi River for the generation of hydroelectricity.

More than $100 million was spent by the National Electricity Co. on overhauling hydroelectric plants and on increasing the utilization rate of currently installed power of the Inga-Shaba hydroelectric complex on the Zaire River. Both Kinshasa and the nearby Lower Zaire region would benefit from the development.

Crude petroleum reserves were about 112 million barrels, and production was estimated at 11.6 million barrels per year from over 100 wells.

Amoco Oil Co. and the Government of Zaire reached agreement in June for production of oil in Lake Tanganyika. Petrofina of Belgium intended to spend $20 million on oil exploration in the lake region. Agreement was also reached between Chevron International Oil Co. and the Société Zairo-Italienne de Raffinage for the supply and refining of crude oil at the Muanda refinery over the 12-month period ending April 1989.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from zaires (Z) to U.S. dollars at the rate of Z123.578=US$1.00 for 1987.

The Mineral Industry of Zambia

By Thomas O. Glover[1]

Copper and byproduct cobalt production continued to dominate the Zambian mining industry in 1987. Their combined value amounted to $925.8 million,[2] which represented 87.8% of the total value of all minerals produced during the year. The value of other minerals produced that were of importance to the Zambian economy was emerald, $32.6 million; cement, $19.4 million; zinc, $18.6 million; lime, $16.4 million; and coal $13.1 million. The combined value of these five commodities was $100.1 million or 9.5% of the total mineral production value. Zambia was the world's fifth largest producer of copper and the second largest producer of cobalt.

The economic situation in Zambia grew progressively worse in 1987. After several years of declining economic conditions in Zambia, it became necessary to seek assistance from the International Monetary Fund (IMF). Zambia had to agree to tough economic measures before financial help could be made available by the IMF. The measures included cuts in civil service, decontrol of interest rates, elimination of price subsidies, and bolstering of agricultural prices to the producers. In addition, a weekly auction was conducted on $9 million of foreign exchange. The austere measures were put in place in 1986 and continued through 1987. The price of food in Zambia rose so high in late 1986 that food riots occurred in Kitwe. Food riots broke out again in mid-May in the Copperbelt. In June, Zambia broke off all negotiations with the IMF. The International Bank for Reconstruction and Development (World Bank) suspended all disbursement of new funds owing to the nonservicing of previous World Bank loans. Zambia's foreign exchange auction had reduced the value of 1 kwacha from $0.455 in October 1985 to $0.067 in January 1987. The value of the kwacha fell so low that Zambia canceled the auction in January. The value of the kwacha was set by Zambia to fluctuate between $0.080 and $0.111 on February 2, 1987.

Owing to Zambia's financial problems, the IMF renegotiated a new foreign exchange auction system that commenced March 28, 1987. In two successive weekly auctions, the value dropped from $0.066 to $0.053 per kwacha on April 11, 1987. Zambia canceled the weekly foreign exchange auction on May 1, 1987, for the second time in a 3-month period. Zambia revalued the kwacha at $0.125. Zambia's external debt totaled $5.8 billion including $600 million in arrears on medium- and long-term debts, when it broke off negotiations with the IMF. Zambia's new Economic Recovery Program, announced August 14, 1987, called for debt servicing of external debt to be considered only after the necessary foreign exchange requirements for the copper industry, the national airlines, and the costs of imported fuel and fertilizers were met. After these needs were taken from the total export earnings, only 10% of the remaining earnings would be allocated to debt servicing. Previously, Zambia had to pay 95% of its foreign exchange export earnings to service its large external debt.

PRODUCTION AND TRADE

Zambia's production of refined copper metal increased 4.9% more than that of 1986, while the production of refined cobalt metal increased 3.1% more than that of 1986. Copper ore milled in fiscal year 1987 (April 1, 1986, to March 31, 1987) increased by 2.8% from that of fiscal year 1986 (April 1, 1985, to March 31, 1986), although the grade of ore decreased slightly. In 1987, Zambia Consolidated Copper Mines Ltd. (ZCCM) production came from 10 underground mines and 3 open pits at the company's 5 producing divisions.

ZCCM has undertaken a comprehensive production and investment program to rationalize its mining activities. Owing to ZCCM's rehabilitation program, the company achieved a real growth in revenues of 1.3% in 1987 compared with a 5.0% decline in 1986. Copper production recorded its first increase in 5 years. ZCCM received a reduction in mineral export tax from 13% to 11% during 1987 and had its mineral tax abolished entirely. The 2% reduction in export tax alone amounted to $18.5 million.

ZCCM was exporting metal shipments through three separate ports in 1987.[3] The Port of East London in the Republic of South Africa was used for 40,867 tons (9%), the Beira Port in Mozambique was used for 35,733 tons (7%), and the Dar es Salaam Port in Tanzania was used for 405,643 tons (84%). This represents a shift in trade routes since 1985 when most copper exports were shipped via the Republic of South Africa ports. Zambia's value of metal exports in 1987 accounted for 91.5% of the country's total value of mineral production.

Zambia received several millions of dollars in grants and low-interest loans for maintaining the Tazara railway line from Zambia to the Dar es Salaam Port in Tanzania during 1987.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
METALS					
Cobalt:					
Mine output, Co content of ore concentrate	3,199	4,620	[e]5,800	[e]5,770	[e]5,950
Metal	2,407	3,472	4,359	4,344	4,479
Copper:					
Mine output:					
Total content of ore	668,688	608,092	614,230	529,421	[e]529,000
Recoverable content of concentrate[2]	540,961	532,679	458,573	461,879	[e]463,000
Leaching (electrowon including that in recoverable content)[2]	134,377	125,909	103,910	139,307	[e]140,000
Metal:					
Blister and anodes, Cu content[e 2 3]	525,000	482,300	[r]463,200	486,000	[e]486,000
Refined[2]	521,871	479,446	460,437	483,040	[e]483,000
Gold[4] troy ounces	10,160	12,185	7,909	1,865	11,253
Iron ore: Magnetite	715	595	984	637	910
Lead:					
Mine output, Pb content of ore	25,865	18,124	15,021	14,851	14,516
Metal, smelter and refined[5]	14,572	8,825	8,873	6,648	7,979
Selenium, recoverable content of:					
Refinery muds kilograms	[2 e]42,752	[e]33,650	[e]37,790	[e]29,870	[e]42,650
Elemental, refined locally[2] do	22,051	17,355	19,490	15,405	22,150
Silver[7] thousand troy ounces	933	795	607	861	961
Tin concentrate, gross weight	22	4	22	3	24
Zinc:					
Mine output, Zn content of ore	55,163	41,128	31,956	33,017	35,443
Metal, smelter plus electrolytic	37,882	29,177	22,766	22,493	21,025
INDUSTRIAL MINERALS					
Cement, hydraulic thousand tons	155	([8])	316	334	375
Clays, building, not further specified do	9	209	2	4	3
Feldspar	226	184	185	214	45
Gem stones:					
Amethyst kilograms	38,799	24,827	19,612	6,991	3,757
Emerald do	17	23	115	413	992
Lime, hydraulic and quicklime thousand tons	193	232	256	243	235
Nitrogen: N content of ammonia	27,800	27,900	17,600	[r]24,494	27,215
Sand, construction	182,752	52,513	38,978	83,593	27,614

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
INDUSTRIAL MINERALS —Continued					
Stone:					
Limestone thousand tons	511	916	702	705	720
Phyllite do	10	17	13	19	22
Miscellaneous (building)	193,625	72,741	108,251	133,804	129,977
Sulfur, elemental basis (produced as sulfuric acid):					
From pyrite	25,513	18,172	28,288	19,187	45,447
From copper ores[e]	79,525	79,000	79,008	74,000	74,000
Total[e]	105,038	97,172	107,296	93,187	119,447
Talc	1,313	367	9,529	266	258
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous thousand tons	453	510	471	557	463
Petroleum refinery products:[2]					
Gasoline thousand 42-gallon barrels	NA	NA	1,016	870	NA
Jet fuel do	NA	NA	350	294	NA
Kerosene do	NA	NA	217	198	NA
Distillate fuel oil do	NA	NA	1,706	1,603	NA
Residual fuel oil do	NA	NA	768	677	NA
Other do	NA	NA	60	51	NA
Refinery fuel and losses do	NA	NA	240	258	NA
Total do	NA	NA	4,357	3,951	NA

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through June 21, 1987.
[2]Data are for fiscal year ending Apr. 1 of that stated.
[3]Includes leach cathodes.
[4]Primarily contained in blister copper and refinery muds.
[5]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 has been made to estimate the trivial difference between the two stages of processing.
[6]Selenium output for fiscal year ending Mar. 31, includes elemental selenium recovered from exported refinery muds by overseas refiners amounting to 20,701 kilograms in 1983.
[7]Refined silver and silver contained in blister copper and refinery muds.
[8]Less than 1/2 unit.

Table 2.—Zambia: Copper production and ore reserves of Zambia Consolidated Copper Mines Ltd., by mine[1]

Mine	Ore milled and treated			Ore reserves		
	Gross weight (thousand metric tons)	Copper grade (percent)	Copper recoverable in copper concentrate (percent)	Gross weight (thousand metric tons)	Copper grade (percent)	Cobalt (percent)
Baluba[2]	2,533	1.55	99.78	46,680	2.50	0.16
Chambishi[2]	1,612	1.63	94.46	29.047	2.70	--
Chibuluma[2]	586	2.44	96.11	8,902	3.24	.19
Kansanshi	--	--	--	4,278	2.97	--
Konkola[2]	1,572	2.94	83.51	48,148	3.87	.07
Luanshya[2]	2,444	1.35	96.97	38.133	2.46	--
Mufulira[2]	4,044	2.02	92.58	80,791	3.13	--
Nchanga[2 3]	9,300	2.63	62.18	114,619	3.68	.53
Nkana[2]	3,557	1.35	93.37	100,643	2.37	.14
Total or average	25,648	2.08	82.44	471,241	3.03	.27

[1]Data shown are for fiscal year Apr. 1, 1986, through Mar. 31, 1987.
[2]Underground.
[3]Open pit.

Source: Zambia Consolidated Copper Mines Ltd. 1987 Annual Report.

COMMODITY REVIEW

METALS

Copper, Cobalt, Byproduct Gold, Selenium, and Silver.—ZCCM treated approximately 24.7 million tons of ore in 1987 yielding about 461,880 tons of copper metal. Ore reserves, as published in ZCCM's 1987 annual report for the year ending March 31, were estimated at 14.28 million tons of contained copper and about 1.27 million tons of contained cobalt. Production of cobalt in 1987 increased slightly.

The Nchanga Div. was ZCCM's largest copper-producing division. The operation was made up of the gigantic Nchanga open pit, plus smaller pits, and three underground mines at Nchanga, Chambishi, and Konkola. Ores from these operations were treated at the Nchanga, Chambishi, and Konkola concentrating plants. The concentrates were then processed at various ZCCM leach plants and smelters located within the Copperbelt.

The Nchanga Div. tailings leach plant, commissioned in 1986, had many technical operational problems throughout the year. The plant treated only 37,395 tons of tailings per day, operating at a 75% plant capacity. Copper recovery from the tailings amounted to only about 1.2%. The Nchanga Div. surface exploration operations consisted of drilling at the Nchanga open pit and the Chambishi underground mine. At Nchanga open pit, a geotechnical evaluation on the north face of the pit was conducted for the purpose of optimizing the design of the pit. At Chambishi, the drilling program to evaluate the resources below the main ore body reserve was completed with favorable results. Underground exploration was conducted at the Nchanga and Konkola Mines. At the Nchanga Mine, a combination of drilling techniques was used to further delineate the ore body. The Konkola Mine completed a dewatering tunnel during the year. A total of 9.3 million tons of ore averaging 2.63% copper was produced by the Nchanga Mines. Nchanga's open pit produced 5,892,000 tons, while the Nchanga underground mine produced 3,408,000 tons. In addition, 188,000 tons of cobalt ore came from the open pit at an average grade of 0.69% cobalt.

At the Nchanga underground mine, ZCCM reported that the secondary mine development achieved the desired target; however, the primary mine development fell below the target owing to a shortage of trained personnel. At the Chambishi underground mine, 1,612,000 tons of ore was mined with an average grade of 1.63% copper. The grade continued to improve owing to the successful program of waste segregation. As part of ZCCM's rationalization program, the Chambishi Mine ceased production in August, after the existing fully developed reserves were depleted. Only the mine and concentrator were closed, with the cobalt plant still operating.

At the Konkola underground mine, 1,572,000 tons of ore was mined grading 2.94% copper. The No. 3 shaft was closed in late July to all hoisting of ore at the Konkola Mine. The average volume of water pumped from the Konkola Mine on a 24-hour basis was 66,670 gallons per minute, making it one of the world's wettest mines. The divisions' concentrator capacity was reduced considerably in September after Chambishi's concentrator was shut down. Their tankhouses and high-grade leach plant production were lower than scheduled owing to below-par feed for the operations. At the Nchanga open pit, 16 additional haulage trucks were changed over to the trolley-assist system. The project has been ongoing for a few years to save diesel fuel and to shorten the transportation time out of the pits. At the end of March, the Nchanga Div. had a labor force of more than 16,000.

The Mufulira Div. copper production came from one of the world's largest underground copper mines, which included surface concentrating, smelting, and refining operations. The mine produced more than 4 million tons of ore that graded slightly over 2% copper. Both quantity of ore and copper production were greater than expected; however, mine production was constrained by equipment unavailability at several levels. At the Mufulira smelter, new anode c,opper production exceeded expectations. Beside processing ZCCM material, the smelter processed Zairean concentrates from the Musoshi and Kinsenda Mines for Roan Selection Trust (RST) Resources Inc. that amounted to 22,970 tons of cathode equivalent. The Mufulira refinery also processed Zairean cathode equivalent, a smelter product, into 26,211 tons of fin-

ished cathode for RST. At the end of March, the Mufulira Div. had a labor force of more than 8,200.

The Nkana Div. copper and cobalt production came from three sections of the Nkana Mine: Mindola, Central Shaft, and the South Ore body, and from the Chibuluma West underground mine. The division was served by two concentrators and the Nkana smelter and refinery. The three Nkana Mine sections produced more than 3.5 million tons that graded slightly over 1.3% copper. Chibuluma produced more than 500,000 tons of ore that graded slightly over 2.4%. The concentration of cobalt in the Nkana copper ore graded 0.10%, whereas Chibuluma ore graded 0.13% cobalt. Nkana's cobalt plant treated mainly low-grade concentrates from all three producing Nkana sites in the division, plus concentrates from Chibuluma. The Nkana Div. produced 2,810 tons of cobalt. At the end of March, the Nkana Div. had a labor force of nearly 14,000.

The Luanshya Div. copper and cobalt production came from the Luanshya and Baluba underground mines. The Luanshya Mine produced only copper, whereas the Baluba Mine produced both copper and cobalt. The two mines together produced slightly less than 5 million tons of ore during 1987. Luanshya's ore graded 1.35% copper, whereas Baluba ore graded 1.55% copper plus 0.12% cobalt. The metallurgical plant consisted of the Luanshya and Baluba concentrators that operated separately designed processing systems for each mine. The Luanshya smelter was put on a standby basis in June 1986. The Luanshya Div. concentrates were treated at either the Mufulira or Nkana smelters after June 1986. Cobalt concentrates from the Baluba Mine were processed at either the Chambishi or Nkana cobalt plants. The Ndola copper refinery, operated by the division, was put on a standby operating basis in January 1987, while the precious metals plant continued to treat refinery anode slime for all ZCCM operations. The Ndola precious metals plant produced 848,683 troy ounces of silver, 86,164 troy ounces of gold, and 22,150 kilograms of selenium in the fiscal year ending March 31, 1987. By the end of March 1987, the Luanshya Div. had a labor force of nearly 9,000.

Lead, Zinc, and Byproduct Silver.—ZCCM's Kabwe Div. operated two mines, one at Kabwe and the other at Nampundwe. The Kabwe Mine produces lead and zinc, whereas the Nampundwe Mine produces a copper-pyrite ore. The Kabwe Mine produces silver as a byproduct of its lead-zinc operation. The Kabwe Mine in fiscal year ending March 31, 1987, hoisted more than 114,000 tons of ore that graded 10.9% lead and 22.9% zinc. The Nampundwe Mine, during the same period of time, hoisted almost 200,000 tons of ore that graded 11.3% sulfur and 0.4% copper. Stocks of sulfur-bearing concentrates totaled slightly more than 17,000 tons at the end of the fiscal year.

INDUSTRIAL MINERALS

Fertilizer Materials.—Nitrogen Chemicals of Zambia worked to improve the yield of a number of its fertilizer plants at the Kafue complex south of Lusaka. The plan included work on the coal gasification unit and on the ammonia, nitric acid, and nitrogen fertilizer production units. Design capacities at Kafue were 79,000 tons per year of ammonia, 127,000 tons per year of nitric acid, 45,000 tons per year of ammonium nitrate, 11,000 tons per year of ammonium sulfate, and 142,000 tons per year of nitrogen-phosphorus-potassium (NPK) fertilizers. The modernization of the plants was scheduled to be completed in 2 years.

Gemstones (Amethyst, Aquamarine, and Emerald).—The production of amethyst in Zambia fell by nearly one-half compared with that of 1986. Even though an agreement was reached between the Government of Zambia and the Lonrho Group in 1986 concerning amethyst mining, no actual mining operations were commenced until late in 1987. The new mining operation was called Kariba Minerals and its marketing arm was called Kariba Amethyst Marketing. A potential market of $2 million per year exists for the amethyst. The mining of small deposits of aquamarine continued in the Lundazi District of Zambia.

Emerald mining and marketing showed strong positive results in 1987. Production of emeralds increased 140%, with the value increasing from $770,000 in 1986 to $32.6 million. For the first time, emeralds ranked third in value of minerals produced, behind copper and cobalt. A new firm, Zambia Emeralds Industry, commenced operation in September 1987 to cut and polish emeralds at the old Ndola Copper Refinery. The firm, with initial capital of $600,000, was established between a Brazilian company and Zambia's Reserved Minerals Corp.

MINERAL FUELS

Coal.—Production of coal at the Maamba Collieries decreased approximately 17% below that of 1986 to slightly more than 463,000 tons valued at $13.1 million, which represented a 77% increase in value from that of 1986. The increase in value came as a result of changes in kwacha valuation and an increase in value per ton. The Maamba Collieries rehabilitation program was slated for completion in 1989.

Petroleum.—*Exploration.*—Two U.S. companies were exploring for oil in Zambia. Placid Oil Co. had three good exploration indications in Luangwa Valley, following commencement of exploration drilling operations on September 14, 1987. Only one well was under way in 1987, although three exploratory wells were planned. Mobil Oil Corp. commenced exploration for oil in the Luano Valley.

Refining.—Ndola's Indeni refinery has been exporting liquefied gas to Burundi, Malawi, Zaire, and Zambia. A byproduct bitumen was also exported to these countries.

Pipeline.—Zambia had a fuel shortage in early 1987 owing to the suspension of pumping operations on the 1,063-mile Tazama pipeline. The pipeline commences at Dar es Salaam, Tanzania, and ends at the Ndola refinery. The operations had ceased because leakage became a major problem. An agreement was signed with two major Italian companies to rehabilitate the pipeline. The rehabilitation project was planned to commence by yearend.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, Zambian kwachas (K) have been converted to U.S. dollars at the rate of K1=US$0.12563; however, the reader is referred to the discussion early in this chapter on the fluctuation of exchange rates during the year.

[3]The Financial Gazette (Harare). Tonnages Shipped Through Ports. Oct. 9, 1987, p. 21.

The Mineral Industry of Zimbabwe

By Thomas O. Glover[1]

Zimbabwe's economy was well developed and diversified with a highly developed infrastructure and a very competitive mining industry. The economy had shown definite signs of recovery during the year. The country's inflation rate in 1987 was 15%.

The value of mineral production for 1987 was estimated at $512 million,[2] a 17% increase. The value did not include downstream products such as ferrochromium, iron, and steel that earned the country a further $150.6 million, bringing the total value of mineral production for 1987 to $662.6 million. Local mining companies increased investments in their industry, thus assuring their future as a prime foreign exchange earner and a sound employment provider. The mineral industry accounted for approximately 40% of all foreign exchange earned in 1987.

Zimbabwe saw an increase in the number of foreign companies that were prospecting for minerals or had indicated the intent to do so in the near future. Companies from Australia, Canada, the Republic of South Africa, the United Kingdom, and the United States have expressed a desire to enter into agreements on mineral prospecting with the Zimbabwean Government. During 1987, 15 exclusive prospecting orders were issued compared with 6 in 1986. Incentives for greater investment allowances were contemplated by the Government as a means of encouraging new mining operations.

The Government of Zimbabwe was interested in expanding existing ferrochromium operations. During 1987, Zimbabwe Mining and Smelting Co. (ZIMASCO) was able to operate all six furnaces at its Kwekwe operation and had a seventh small furnace under construction. Two other major units were also under consideration at Kwekwe. All furnaces at Zimbabwe Alloys Ltd. (Zimalloys) will have been commissioned by the end of 1988. Plans were under way at ZIMASCO to increase the production of high-carbon ferrochromium. The Government was also interested in exploiting platinum-group metals (PGM). Some apprehension exists on exploitation of PGM in Zimbabwe owing to projected production increases in the Republic of South Africa. Although PGM operations would be economic by 1987 values, the increased production from the Republic of South Africa might make it difficult for Zimbabwe to be competitive on the world market.

Mineral exploration activity during 1987 was centered on old gold mines and their associated tailings dumps and on petroleum and uranium prospecting sites in the Zambezi Valley. The 1987 amendment to the Mines and Minerals Act allowed the Zimbabwean Government to repossess the mining block on which old tailings were not being reclaimed properly and to reissue permits to other interested parties or to transfer operation to Zimbabwe Mining Development Corp. (ZMDC), the parastatal mining company. Uranium deposits were found near Mashumbi Pools in north-central Zimbabwe near the Zambian border. The uranium exploration was conducted by Saarberg Interplan Uran GmbH of the Federal Republic of Germany. The quantities and grades of the uranium reserves were reported as promising. There was no reported finding of petroleum during 1987.

ZMDC conducted other exploration of diatomaceous earth, molybdenum, and rare-earth deposits. Deposits of high-grade copper were also sought near the Botswana border. Diamond prospects in the Midlands

were investigated by the Shabani and Mashaba Mines (Pvt.) Ltd.

Prior to 1987, all governmental mining investments were held by either the ZMDC or the Industrial Development Corp. (IDC) of Zimbabwe. In 1987, ZMDC was given responsibility for all mining investments, except for two mining-related subsidiaries still held by IDC.

PRODUCTION AND TRADE

Production of mineral commodities in Zimbabwe, in most instances, increased in 1987. Gold, the most important mineral mined during 1987, was valued at $210.8 million accounting for 32% of the total value of all exported minerals. In addition to newly mined gold, gold metal reserves of $46.4 million were also exported. Zimbabwe was the 12th largest producer of gold in the world; however, its production amounted to less than 1% of the total world production. Production of asbestos was valued at $59 million. The values of chromium, copper, iron ore, nickel, and phosphates also increased during the year.

There were considerable investments by the existing local mining companies in Zimbabwe during 1987. The size of their investments showed optimism regarding mining's earnings in the coming years. A number of foreign companies were also prospecting in the country. Various industry groups argued that, in the interest of promoting mining growth, the Government of Zimbabwe should give greater investment incentives to these companies. They also claimed that the main constraint on the mining industry's economic contribution has been inadequate Government allowances of foreign exchange to purchase maintenance parts and new equipment.

Zimbabwe commenced building a new $4.5 million explosive manufacturing plant at Kwekwe in May 1987. The plant was owned by IDC (51%), Nitro Nobel (Sweden) (25%), and the Swedish Fund for Industrial Cooperation with Developing Countries (24%). The plant, scheduled for completion by March 1988, would produce 4,000 tons of explosives annually for the mining industry.

Zimbabwe's Mines and Minerals Act was amended in 1987. One change provided that dumps on mining locations would have to be worked, if economically viable, and not simply held by claimholders. The new law provided the Ministry of Mines the authority to investigate mine dumps to determine whether any dump that was idle could be economically worked. If so, the claim holder should be ordered to work the dump; and, in case of noncompliance, ordered forfeiture of the claim. Another provision of the amendments stated that only permanent residents or their appointed agents may take out prospecting licenses.

Although, in local value, exports of commodities increased 11% and imports increased 16% during the year, the Zimbabwean dollar depreciated approximately 13% against the U.S. dollar, which left the real value of exports slightly lower for the year. During the year, Zimbabwe utilized the Beira railway and port for more imports and exports than in 1986. U.S. exports to Zimbabwe increased $219 million in 1987. The value of asbestos exported from Zimbabwe during 1987 was $59 million.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
METALS					
Aluminum: Bauxite, gross weight	23,145	22,726	20,877	24,284	--
Antimony, mine output, metal content[2]	143	256	194	175	--
Beryllium: Beryl concentrate, gross weight	47	19	38	103	83
Chromium: Chromite, gross weight thousand tons	431	477	536	533	570
Cobalt:					
Mine output, recoverable Co content[e]	73	78	100	76	110
Metal (including content of refinery sludges)	73	78	92	76	110
Columbium and tantalum: Tantalite concentrate:					
Gross weight kilograms	2,480	59,000	40,000	33,000	37,000
Cb content[e] do	370	8,850	6,000	4,950	3,650
Ta content[e] do	870	20,650	14,000	11,550	6,600
Copper:					
Mine output, Cu content	21,600	24,000	21,570	21,390	[e]19,710

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
METALS —Continued					
Copper —Continued					
Metal:[3]					
Smelter, primary[e]	21,600	23,000	20,670	20,500	19,000
Refinery, primary	21,560	22,687	20,389	20,423	18,819
Gold, mine output, Au content thousand troy ounces	453	478	472	478	473
Iron and steel:					
Iron ore:					
Gross weight thousand tons	926	927	1,100	1,110	1,328
Fe content[e] do	555	555	660	670	824
Metal:					
Pig iron[e] do	584	400	674	644	575,000
Ferroalloys:					
Ferromanganese	2,085	1,845	2,044	2,000	--
Ferrochromium	157,914	177,800	156,000	155,000	212,300
Ferrosilicon	27,542	42,482	53,527	50,000	21,192
Total	187,541	222,127	211,571	207,000	233,492
Steel, crude thousand tons	672	391	[e]465	490	515
Nickel:					
Mine output, Ni content[e]	12,020	12,150	11,116	10,370	12,320
Metal, smelter[4]	10,146	10,251	9,381	9,730	10,394
Platinum-group metals:					
Platinum troy ounces	1,693	772	611	836	579
Palladium do	2,395	1,222	965	1,125	932
Total do	4,088	1,994	1,576	1,961	1,511
Silver, mine output, Ag content thousand troy ounces	935	893	799	841	815
Tin:					
Mine output, Sn content[e]	1,700	1,670	1,670	1,470	1,410
Metal, smelter	1,234	1,210	1,207	1,079	1,038
Tungsten, concentrate output:					
Gross weight	22	55	14	2	1
W content[e]	15	29	10	2	1
INDUSTRIAL MINERALS					
Abrasives: Natural corundum	5,120	--	--	--	--
Asbestos thousand tons	153	165	173	164	194
Barite	980	700	400	298	191
Cement, hydraulic thousand tons	580	[e]650	[e]700	[e]750	811
Clays:					
Bentonite (montmorillonite)	63,097	[e]64,000	[e]68,000	71,987	[e]72,000
Fire clay	9,255	8,900	9,747	12,591	16,022
Kaolin	470	1,350	1,104	901	780
Feldspar	1,645	1,399	2,300	2,026	2,962
Gem stones, precious and semiprecious:[5] Emerald kilograms	[e]5	8	13	59	1,979
Graphite	8,000	12,334	10,450	15,000	13,530
Kyanite	--	--	--	1,851	--
Lithium minerals, gross weight	19,193	22,548	27,910	32,760	14,959
Magnesite	24,071	21,642	19,385	22,649	28,991
Mica	544	911	582	1,340	800
Nitrogen: N content of ammonia thousand tons	71	69	69	60	65
Phosphate rock, marketable concentrates do	133	134	135	136	155
Pigments, iron oxide[e]	1,000	1,000	--	207	--
Pyrite, gross weight thousand tons	57	57	57	63	47
Quartz[5] do	47	32	103	145	41
Stone: Limestone do	1,222	1,152	1,323	1,407	1,537
Sulfur:[e]					
S content of pyrite do	24	25	25	25	25
Byproduct of coal and metallurgy do	5	5	5	5	5
Total do	29	30	30	30	30
Talc	551	285	437	797	516
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous thousand tons	3,437	3,110	3,120	4,047	4,858
Coke, metallurgical[6] do	203	[e]200	[e]200	[e]200	592

[e]Estimated. [p]Preliminary.

[1]Table includes data available through Aug. 12, 1988.

[2]Content of concentrates.

[3]Smelter copper includes impure cathodes produced by electrowinning in nickel processing.

[4]May include Ni content of nickel oxide.

[5]Includes rough and ground quartz as well as silica sand.

[6]Data represent output by the Wankie Colliery Co. Ltd. for years ending Aug. 31 of those stated; additional output by the Redcliff plant of Zimbabwe Iron and Steel Co. may total 250,000 metric tons per year of metallurgical coke and coke breeze.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	--	256	--	All to Belgium-Luxembourg.
Metal including alloys, unwrought	--	63	--	All to France.
Beryllium: Ore and concentrate	18	--		
Chromium: Ore and concentrate	11,552	2,156	1,958	Morocco 198.
Cobalt: Metal including alloys, all forms	1,045	--		
Columbium and tantalum:				
Ash and residue containing columbium and tantalum	--	421	--	All to West Germany.
Metal including alloys, all forms, tantalum value, thousands	[2]$178	--		
Copper:				
Matte and speiss including cement copper	203	602	--	Norway 518; West Germany 84.
Ash and residue containing copper	102	556	--	All to West Germany.
Metal including alloys:				
Scrap	10	--		
Unwrought	[2]17,580	[2]21,660	--	Italy 12,453; Japan 2,017; Austria 1,629.
Gold: Metal including alloys, unwrought and partly wrought troy ounces	643	830	--	All to Netherlands.
Iron and steel: Metal:				
Pig iron, cast iron, related materials	[2]28	[2]605	--	NA.
Ferroalloys:				
Ferrochromium	[r]101,336	113,220	38,588	West Germany 33,778; Italy 24,018.
Ferromanganese	--	93	--	Philippines 55; Thailand 38.
Ferrosilicochromium	20,189	20,795	4,829	West Germany 14,248; Spain 1,571.
Unspecified	71,264	113,125	--	West Germany 48,561; Japan 39,879; Italy 24,018.
Steel, primary forms	[2]243,495	[2]158,255	--	NA.
Semimanufactures:				
Bars, rods, angles, shapes, sections	[2]95,484	[2]139,542	25	NA.
Universals, plates, sheets	14,563	3,473	2,417	Morocco 1,048.
Hoop and strip	205	29	--	All to Morocco.
Rails and accessories	[2]4,241	--		
Wire	[2]10,337	[2]9,239	--	NA.
Tubes, pipes, fittings	33	404	--	Portugal 295; Netherlands 88.
Lead: Metal including alloys, unwrought	35	--		
Lithium: Ore and concentrate	[2]28,117	[2]22,837	8,237	NA.
Nickel:				
Matte and speiss	12	275	--	Norway 260.
Metal including alloys, all forms	[r 2]10,896	[2]14,326	2,843	Japan 3,362; West Germany 1,660.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$3	$51	--	Switzerland $31; United Kingdom $20.
Silver:				
Ore and concentrate do	--	$1	--	All to United Kingdom.
Waste and sweepings do	$93	$2,337	--	All to West Germany.
Tin: Metal including alloys, all forms	[r 2]1,147	[2]1,322	123	West Germany 351; France 91.
Titanium: Metal including alloys, all forms	[2]73	--		
Tungsten: Ore and concentrate	[2]36	--		
Other:				
Ores and concentrates	449	--		
Ashes and residues	1,126	28	--	United Kingdom 21; West Germany 7.
Base metals including alloys, all forms	--	108	--	Norway 103.
Precious metals including alloys, waste and scrap value, thousands	[2]$2,282	[2]$816	--	NA.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Dust and powder of precious and semiprecious stones including diamond do	--	$82	$82	
Asbestos, crude	[2]158,633	[2]167,970	193	Japan 36,920; Spain 15,577; Italy 8,176.
Cement	[2]73,789	[2]77,929	--	NA.
Clays, crude	36	--		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Diamond:				
Gem, not set or strung value, thousands	[2]$2,035	[2]$ 4,201	$27	NA.
Industrial stones do	--	$26	--	All to France.
Feldspar, fluorspar, related materials	--	180	--	All to Taiwan.
Fertilizer materials: Manufactured:				
Phosphatic	NA	3,168	--	All to Czechoslovakia.
Unspecified and mixed value, thousands	[2]$964	--		
Graphite, natural do	r [2]$4,759	[2]$7,024	--	NA.
Kyanite and related materials	--	18	--	All to Japan.
Magnesite, crude value, thousands	[2]$417	[2]$691	--	NA.
Mica: Crude including splittings and waste	--	657	--	All to Spain.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$741	$1,396	$6	Switzerland $1,901; West Germany $234.
Synthetic do	--	$30	$30	
Stone, sand and gravel	[2]264,629	[2]29,579	([3])	Japan 5,151; Italy 2,121.
Other: Crude	r262	4,516	--	Japan 3,390; West Germany 1,036.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	477	--		
Coal: All grades including briquets	[2]118,844	[2]64,645	--	NA.
Coke and semicoke	[2]89,612	[2]113,133	--	NA.

[r]Revised. NA Not available.

[1]Table prepared by Virginia A. Woodson. Owing to a lack of official trade data published by Zimbabwe, this table should not be taken as a complete representation of this country's mineral exports. These data have been compiled from various sources, which include United Nations information, data published by trading partner countries, and partial official trade data of Zimbabwe. Unless otherwise specified, data are compiled from trade statistics of individual trading partners.

[2]Central Statistical Office, Harare, Zimbabwe. Quarterly Digest of Statistics. Dec. 1987.

[3]Unreported quantity valued at $234,000.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	10	1	1	
Metal including alloys:				
Unwrought	423	303	--	All from Netherlands.
Semimanufactures value, thousands	[2]$7,074	[2]$8,622	$258	NA.
Chromium: Oxides and hydroxides	3	4	--	All from United Kingdom.
Cobalt: Oxides and hydroxides	--	1	1	
Copper:				
Ash and residue containing copper	--	54	54	
Metal including alloys:				
Scrap	8	--		
Unwrought	3	16	15	West Germany 1.
Semimanufactures	38	99	3	Italy 34; Canada 29; United Kingdom 22.
Iron and steel: Metal:				
Scrap	--	31	--	All from United Kingdom.
Pig iron, cast iron, related materials	33	46	--	Canada 17; Sweden 17; Italy 10.
Ferroalloys:				
Silicon metal	2	22	--	All from United Kingdom.
Unspecified	5	--		
Semimanufactures:				
Bars, rods, angles, shapes, sections value, thousands	[2]$6,048	[2]$6,561	--	NA.
Universals, plates, sheets do	[2]$29,515	[2]$39,692	--	NA.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel: Metal —Continued				
Semimanufactures —Continued				
Hoop and strip	89	360	--	Italy 170; Japan 83; Belgium-Luxembourg 82.
Rails and accessories	1	--		
Wire	333	187	--	Belgium-Luxembourg 88; United Kingdom 88.
Tubes, pipes, fittings value, thousands	[2]$4,663	$3,895	$4	NA.
Castings and forgings, rough	--	225	--	All from Italy.
Lead: Metal including alloys, semimanufactures	2	1	--	All from United Kingdom.
Manganese:				
Ore and concentrate: Metallurgical-grade	--	209	--	All from Netherlands.
Oxides	--	18	--	All from Greece.
Molybdenum: Metal including alloys, all forms	--	2	--	All from United Kingdom.
Nickel: Metal including alloys, semimanufactures	--	4	(3)	Mainly from United Kingdom.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	--	$7	--	All from United Kingdom.
Silver: Metal including alloys, unwrought and partly wrought do.	$3	$97	--	Netherlands $96.
Tin: Metal including alloys, semimanufactures	--	13	--	All from Australia.
Titanium:				
Oxides	20	3	--	All from Denmark.
Metal including alloys, semimanufactures	1	--		
Vanadium: Pentoxides	--	8	8	
Zinc:				
Oxides	110	28	--	Hong Kong 15; Italy 13.
Metal including alloys, all forms value, thousands	[2]$4,106	[2]$3,793	--	NA.
Other: Base metals including alloys, all forms	--	3	2	United Kingdom 1.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	40	151	--	Greece 139; Italy 12.
Grinding and polishing wheels and stones	22	[4]12	(5)	West Germany 5; Norway 3; Italy 2.
Boron materials:				
Crude natural borates	434	--		
Oxides and acids	--	4	4	
Cement	2	--		
Chalk	77	38	--	All from France.
Clays, crude	19	--		
Diamond:				
Gem, not set or strung value, thousands	--	$2	--	All from United Kingdom.
Industrial stones do.	$23	$2	$2	
Diatomite and other infusorial earth	70	--		
Fertilizer materials: Manufactured:				
Ammonia value, thousands	[2]$6,089	[2]$9,996	--	NA.
Nitrogenous	5	9,683	--	Belgium-Luxembourg 4,005; West Germany 3,150.
Potassic	10,182	18,414	--	All from West Germany.
Graphite, natural	1	5	--	Do.
Gypsum and plaster	18	163	3	West Germany 159.
Lime value, thousands	[2]$1,462	[2]$3,013	--	NA.
Magnesium compounds:				
Magnesite, crude do.	$8	--		
Other	--	1	1	
Mica: Worked including agglomerated splittings	1	1	--	All from United Kingdom.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$24	$125	--	All from Switzerland.
Synthetic do.	$1	--		
Salt and brine	9,230	7,542	--	West Germany 7,403; United Kingdom 139.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sodium compounds, n.e.s.: Carbonate, manufactured	18	72	--	All from France.
Stone, sand and gravel: Sand other than metal-bearing	6	--		
Sulfur:				
Elemental:				
Crude including native and by-product	75	--		
Colloidal, precipitated, sublimed	--	4	--	All from United Kingdom.
Sulfuric acid	1	--		
Talc, steatite, soapstone, pyrophyllite	20	36	--	All from Republic of Korea.
Other: Crude	5	11	--	West Germany 7; United Kingdom 4.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	53	1	--	All from United Kingdom.
Carbon black	909	55	--	United Kingdom 37; Netherlands 11.
Coal: All grades including briquets value, thousands	[2]$7,092	[2]$15,743	--	NA.
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	12	--		
Gasoline do	[r]152,670	480	--	All from Netherlands.
Mineral jelly and wax do	7,107	12,608	--	West Germany 6,753; Hong Kong 4,997.
Kerosene and jet fuel do	70	9	--	All from United Kingdom.
Distillate fuel oil do	[r]192,226	97	--	All from West Germany.
Lubricants do	5,123	10,476	88	West Germany 5,068; France 4,732.
Bitumen and other residues do	103	315	--	All from Italy.
Bituminous mixtures do	8,968	503	--	All from United Kingdom.
Petroleum coke do	176	--		

[r]Revised. NA Not available.

[1]Table prepared by Virginia A. Woodson. Owing to a lack of official trade data published by Zimbabwe, this table should not be taken as a complete representation of this country's mineral imports. These data have been compiled from various sources, which include United Nations information, data published by trading partner countries, and partial trade data of Zimbabwe. Unless otherwise specified, data are compiled from trade statistics of individual trading partners.

[2]Central Statistical Office, Harare, Zimbabwe. Quarterly Digest of Statistics. Dec. 1987.

[3]Less than 1/2 unit.

[4]Excludes unreported quantity exported by Canada valued at $20,000.

[5]Unreported quantity valued at $8,000.

COMMODITY REVIEW

METALS

Chromite.—The production of chrome ore in Zimbabwe came from 2 major producers and 19 small mining cooperatives. The two major producers, ZIMASCO and Zimalloys, mined almost entirely in the podiform deposits; whereas, the artisan miners worked entirely in the more-difficult-to-excavate stratiform deposits.

The mining cooperatives, which have been in existence since 1982, leased areas that were formerly mined by major companies and then sold the high-grade ore to ZIMASCO and Zimalloys for processing. Mining cooperatives earned more than $5 million from sales of 73,000 tons of chromium ore to ZIMASCO and Zimalloys. The cooperatives supplied about 20% of the chromium ore refined at Gweru and Kwekwe. Zimbabwe had 19 cooperatives mining high-grade chromium ore on the North Dyke. Zimalloys and ZIMASCO received about 27% and 12%, respectively, of their ore from these operations. ZMDC negotiated a guaranteed chromium ore price with the two major producers. The cooperatives received about $20 per ton for chromium ore.

Zimalloys was owned by the Anglo Amer-

ican Corp. Ltd. (60%), John Brown & Co. Ltd. (17%), Old Mutual of Zimbabwe (6%), French interests (5%), and public sources (12%). The company employed 1,330 people at five chromium mining operations and seven small cooperatives. The five mines were the Caesar, Great Dyke, Inyala, Netherburn, and Sutton. The Zimalloys smelter, at Gweru in central Zimbabwe near the mines, produced low-carbon ferrochromium, and ferrosilicon from three batteries that operated 24 hours per day, 365 days per year. Coal and coke to fuel the batteries came from Wankie Colliery Co. Ltd. in northwest Zimbabwe near Victoria Falls. The final products were shipped in 500-kilogram barrels to customers in Australia, Japan, and the United Kingdom.

ZIMASCO, a subsidiary of Union Carbide Corp. of the United States, had 6 mines and 12 small cooperatives producing chromium ore. The company employed 2,577 people at its sites. The producing mines were the Iron Ton, Lalapanz (Cambrae), Magazine Hill, North Section (Railway Block), South Section (Peak), and Valley. ZIMASCO produced only high-carbon ferrochromium at its Kwekwe facilities, utilizing all six furnaces. All coal and coke to fuel the furnaces came from the Republic of South Africa.

During October 1987, the Zimbabwean Government requested most-favored-nation duty-free treatment for its ferrochromium and ferrosilicon exports to the United States. Approval had not been granted by the United States at yearend. The U.S. duties were 3.4% on low-carbon ferrochromium and 10.0% on ferrosilicon at the time of the request.

Cobalt.—Bindura Nickel Corp. Ltd. (BNC) was the only local mine producer of byproduct cobalt in Zimbabwe during 1987. The cobalt appears in a low-grade sulfide ore along with nickel, copper, and small amounts of precious metals. BNC, a subsidiary of Anglo American, produced the sulfide ore from four mines in Zimbabwe: Epoch, Madziwa, Shangani, and Trojan. The Trojan refinery treats the ore from all four mines. In addition to local cobalt production, Rio Tinto (Zimbabwe) Ltd. (RTZ) recovered additional byproduct cobalt, on toll, at the Eiffel Flats refinery, processing nickel-copper-cobalt matte from Botswana's Selebi-Phikwe operation.

Copper.—Copper ore was produced by two Zimbabwean companies in 1987; Mhangura Copper Mines Ltd. (MCM) and Lomangundi Smelting and Mining (Pvt.) Ltd. (LSM). Another source of copper was Botswana's Selebi-Phikwe nickel-copper matte, which was toll refined for export at RTZ's Eiffel Flats refinery. Copper concentrates were also purchased from the Muconguera Mine in Mozambique for processing.

MCM operated two mines (Miriam and Norah) and the Alaska smelter and refinery. ZMDC owned approximately 55% of MCM. Working profits were improved during the last half of 1987 owing to market conditions and fewer costly plant and equipment breakdowns. Copper sales increased by 8.7% despite a reduction in ore production. MCM also entered into a contract with Lonrho Zimbabwe Investment Group to process a small amount of its copper concentrates at MCM's Alaska smelter. ZMDC was considering the feasibility of upgrading copper cathode for the export market. If the project appeared to be economically sound, it would be carried out at the Alaska refinery.

LSM, a ZMDC company, operated the Angwa and Avondale Mines. The company continued to operate at a loss owing to poor production. The copper ores were processed at the old Shackleton Mine concentrator. Extensive exploration and development work, begun in 1986, was continued in 1987. The ore reserves found were sufficient to extend the life of the mines until 1990.

Lonrho Zimbabwe Ltd. had plans to close its Inyati Mine near Rusape in eastern Zimbabwe during January 1988. The smelter and refinery were scheduled to be closed during April 1988. The mine, which opened in 1902, produced copper and byproduct gold.

Gold.—There were 10 main participants in gold activities at 46 sites in Zimbabwe during 1987. Thirty-seven of the sites were mines, four were leaching operations at old mine dumps, three were claims, and two were prospects. Six of the operators were significant producers: Cluff Mineral Exploration (Zimbabwe) Ltd. (CMEZ), Falconbridge Investments (Zimbabwe) (Pvt.) Ltd., Falcon Mines PLC, Lonrho, RTZ, and the parastatal ZMDC.

CMEZ operated the Royal Family Mine and completed feasibility studies on the Freda oxide deposit and the Freda and Rebecca sulfide deposits. CMEZ decided to proceed with the construction of two open pit mines. The Freda oxide mine was scheduled to produce 14,000 troy ounces of gold per year from a 600,000-ton-per-year heap-leaching operation starting early in 1988.

Test pits have shown that the ore can be mined without blasting and treated as is to recover over 80% of contained gold. The Freda-Rebecca sulfide mines were scheduled to produce 50,000 ounces of gold per year from 729,000 tons per year of ore from the two sites. The recovery rate from the plant was to be 85% to 90%, and production was scheduled to begin in late 1988. The Royal Family open pit mine produced approximately 9,000 ounces of gold in 1987 and its first production was in 1984.

Falconbridge operated two underground gold mines, the Blanket and Golden Kopje, producing a total of 24,970 ounces. At the Blanket Mine, 160,000 tons of ore was milled to produce 17,026 ounces of gold. At the Golden Kopje Mine, 79,400 tons of ore was milled to produce 7,944 ounces of gold. Proven and probable ore reserves at the Blanket Mine were 534,000 tons with a grade of 5.3 grams (0.17 ounce) per ton. At the Golden Kopje Mine, proven reserves were 73,000 tons with a grade of 6.1 grams (0.20 ounce) per ton. Falconbridge was developing the Three Cheers Prospect in 1987. This prospect contained 800,000 tons of oxidized surface ore with a grade of 2.0 grams (0.06 ounce) per ton.

Falcon Mines operated the Dalney Group and Venice Group of mines during 1987. In addition, the Old Nick underground mine, owned by Olympus Consolidated Mines Ltd., a subsidiary of Falcon Mines, embarked on a $3 million expansion project to double the tonnage milled. In 1987, approximately 2,000 tons of ore per month was milled that yielded up to 10 grams (0.32 ounce) of gold per ton. After the tonnage of ore to the mill is doubled, the grade will drop to 8 grams of gold (0.26 ounce) per ton. The Dalney Mine was sinking a new 6-meter-diameter shaft that cost $5 million. The new shaft will provide the means to increase production and will increase the feasibility of mining at greater depths, which will in turn increase the life expectancy of the mine. The retreatment of the What Cheer Mine dump was started in 1987 and results were promising.

Lonrho and its subsidiaries operated 11 gold mines in Zimbabwe. Their mines included Anzac, Arcturus, Athens, Gladstone, Howe No. 3, Mazowe, Monarch, Muriel, Redwing, Shamva, and Tiger Reef. Shamva, the third-largest gold producer in Zimbabwe during 1987, was approved for a 2-year major expansion program late in 1987. Expanding the Shamva mill would increase production of gold ore from 13,500 to nearly 20,000 tons per month raising gold production from 1,800 to about 2,570 ounces per month. The expansion at Shamva was expected to cost nearly $10 million. The Tiger Reef Mine also started a $2 million expansion program. When completed, milling would increase from 7,500 to about 10,000 tons per month. Exploration continued at the Monarch Mine on the Mozambique border near Mutare. Lonrho purchased Corsyn Consolidated Mines Ltd. from the Republic of South Africa based Coronation Syndicate Ltd. Included in the sale were the Anzac, Arcturus, Mazowe, and Muriel Mines.

RTZ operated three gold mines and three mine dump-leaching operations. Renco Mine, the largest gold producer in Zimbabwe, produced approximately 65,000 ounces of gold per year. The other two mines, Brompton and Patchway, produced approximately 8,500 ounces of gold each.

ZMDC and two of its subsidiaries were involved in nine gold mining operations during 1987. The development of the old Elvington Mine was announced late in the year. The mine had been abandoned in the 1930's, but still contains reserves of approximately 3.7 million tons of ore. ZMDC was planning a 150,000-ton-per-year operation for Elvington Mine at an average gold content of 5.5 grams per ton. Total development costs at Elvington Mine will be from $9 to $12 million. ZMDC's Jena Mines (Pvt.) Ltd. owns and operates three gold mines. The mines, Leopard and Leopardess, both started before 1915, and Termite, at least 40 years old, were in the process of being renovated. A new $3.5 million gold reduction commissioned early in 1987 at the Jena operation, 80 kilometers west of Kwekwe. The new plant capacity of 300 tons per day was three times greater than the old capacity and will increase the recovery of gold from 65% to 93%.

A relative newcomer to Zimbabwe, in terms of gold mining, was the Australian gold producer, the Sons of Gwalia (Zimbabwe) (Pvt.) Ltd , a subsidiary of Chase Minerals. It was involved in approximately 12 projects, which included the Steamboat-Better Group, Redrue Kop Group, Adzwe Mine, Mont D'Or Mine, and the Connemara Mine.

Zimbabwe's first gold refinery was under construction in 1987 and due for completion in March 1988. Technical assistance was provided by the Australian Perth Mint Co.

The plant's capacity of 50 tons (1.46 million ounces) of gold per year exceeds the expected 1987 needs by approximately 34 tons (990,000 ounces). Break-even operation of the plant was estimated to be 30 tons (880,000 ounces) of gold per year.

Iron and Steel.—The Buchwa Iron Mining Co. (Pvt.) Ltd. produced 1.3 million tons of iron ore concentrates for Zimbabwe Iron and Steel Co. Ltd. (ZISCO) steel mill at Redcliff, Zimbabwe. The 1987 production amounted to a 6.4% production increase when compared with that of 1986. Of the total iron ore produced at its two open pit mines, 874,315 tons (69%) came from the Buchwa Mine and 397,150 tons (31%) came from the Ripple Creek Mine. Buchwa Mine production was 6.7% lower and Ripple Creek Mine production was 54% higher than in 1986.

ZISCO's plant complex had an annual capacity to produce 1 million tons of crude steel, and it was ranked as the second-largest steel producer in southern Africa. In 1987, the mill produced 597,000 tons of crude steel, a 11.4% decrease from its 1986 production. A new managing director was appointed in 1987 to head up ZISCO along with an all new 12-member board. A new $370,000 study began in 1987 and was designed to help develop domestic, regional, and other exports as the first step in a new $300 million rehabilitation program for ZISCO. The market study would identify the major iron and steel users in the Africa Preferential Trade Area region, which embraced 15 countries in eastern and southern Africa, and assess growth potential over the next 10 years and ZISCO's ability to meet expected demands.

Nickel.—The only nickel producer from nickel ore in Zimbabwe was Anglo American's BNC. The average grade of nickel in the ore was 0.6%. Although the company made net operating profits during the year, its financial stability was threatened by a high debt burden. The Bindura smelter and refinery toll refined nickel-copper matte from Botswana's nickel-copper-cobalt mine at Selebi-Phikwe. It also toll refined nickel sulfates from the Republic of South Africa. RTZ also operated its Eiffel Flats refinery for the same toll products.

BNC operated four nickel mines in 1987, Epoch, Madziwa, Shangani, and Trojan. Although Anglo American remained a major shareholder in BNC, credit facilities from the Anglo American group were exhausted and BNC had to seek total financing from the Zimbabwean Government. Loans to BNC by Anglo American were scheduled to be repaid by the end of the calendar year. Despite the rise in nickel prices late in 1987, discussions were held about closing the mines and refinery owing to the high debt burden. The decision to close the operations depended on whether the Government could provide financial assistance and whether Anglo American Zimbabwe would forgive BNC's debt.

Tin.—Kamativi Tin Mines Ltd. completed its first full year under ZMDC management in 1987. The operations, procured in November 1986, underwent considerable modifications. ZMDC held 91.3% of all the stock in Kamativi, and the remaining stock was held by private overseas investors. The company planned to double its output of tantalite concentrates to almost 9 tons per month in the near future. Kamativi planned a new plant that would split the heavy-mineral fraction into a 65% tin concentrate, a 36% tantalum pentoxide concentrate, and a 52% niobium pentoxide concentrate. KHD Humboldt Wedag AG was scheduled to supply the core units for the preparation plant, which included a low-intensity wet magnetic separator, a high-intensity Jones magnetic separator, and a secondary drying facility.

The deposits of pegmatitic tin ores at Kamativi contained feldspar, biotite, muskovite, lepidolite, quartz, and columbite with grades ranging from 80 to 200 parts per million columbium (niobium). The pegmatite also included garnet, which was removed by dry magnetic separation.

INDUSTRIAL MINERALS

Asbestos.—Asbestos production came from two underground mines, the King Mine in the Mashaba area and the Shabanie Mine near Zvishavane. Production of asbestos increased by 18% over that of 1986 to approximately 194,000 tons. The value of asbestos decreased by $10.21 per ton in 1987 to $304 per ton.

The King Mine had its own 120,000-ton-per-year mill on the site. The mine and mill were run on a three-shift basis utilizing 1,200 employees, 50% of which worked underground and 960 (80%) were semiskilled or unskilled. The King mill processed three grades of asbestos.

The Shabanie Mine had its own 200,000-ton-per-year mill on the site. The 350-foot-high Shabanie mill contained 16 stories above ground and 2 below ground. The mill

cost $100 million and employed 1,066 people; 106 were professionals and 960 were semiskilled or unskilled. Six grades of asbestos were produced at Shabanie, grading No. 1 as the poorest and No. 6 as the best, which was composed of long fibers that were exceptionally clean. Asbestos at the Shabanie mill was shipped to customers in 50-kilogram plastic bags. Sales were made to the Middle East and Far East countries and to Eastern and Western European countries.

India signed two trade barter contracts with Zimbabwe during 1987 to take $7.8 million in asbestos up to July 1988. Part of the proceeds from the contracts accrued as foreign exchange, but the larger part was allocated by the Government for imports of essential mining parts and machinery from India. Fourteen local Zimbabwean factories used Zimbabwean asbestos to produce a variety of products for domestic and export markets. The local factories employed 2,000 people.

Graphite.—Graphite was produced by the Lynx Mine in northern Zimbabwe's Karoi area. The mine was formerly known as the Gwerman Graphite Mine. ZMDC took control of the mine from the IDC in late 1987 after lengthy negotiations. Production decreased, although profits increased in 1987. The graphite was marketed in flake and powder form to buyers principally in the Federal Republic of Germany, France, the Republic of South Africa, Spain, Taiwan, the United Kingdom, the United States, and Zambia.

Kyanite.—ZMDC shipped 34 tons of kyanite and 17 tons of plastic clay to India for pilot plant tests on making refractory brick in 1987. The kyanite was produced at ZMDC's mine near Mutoko.

Lithium.—Bikita Minerals (Pvt.) Ltd.'s mine, founded in 1952 and located 80 kilometers east of Masvingo, was the sole producer of lithium minerals in Zimbabwe. The petalite ore from the Al Hyat quarry was processed to yield spodumene and lepidolite concentrates and pollucite. Although production was planned to be increased to 74,000 tons per year, the mine did not operate in 1987. Large stockpiles of petalite ore were sufficient to feed a new $3.5 million triflow-separator plant that had not previously been used to process petalite, only coal. The new plant's success was due to the expertise of British Petroleum Minerals (BP), the major stockholder in Bikita. The $3.5 million expansion program has changed the mine's operations and future. The life of the mine was extended by more than 21 years. Sale of lithium products decreased by 54% in 1987 as a result of bringing the new plant on-line. The other shareholders in Bikita were AMAX Inc. and Kerr McGee Chemical Corp., both U.S. companies. Lithium was used in the production of zero expansion glass, frits and enamels, and as a flux in the steel industry.

MINERAL FUELS

Coal.—Wankie Colliery Co. Ltd., the only coal mining operation in Zimbabwe, included an underground mine and an open pit with a coal preparation plant at each of the two mines. Anglo American purchased the operations at Wankie in 1953 and controlled the operations until Zimbabwe's independence in 1980, when the Zimbabwean Government took control of the mines. Anglo American continued to manage the mines through September 1987, when ZMDC took over the management role. The Zimbabwean Government took control in 1980 by purchasing 40% of Anglo American's stock. Several other minority stockholders still hold some shares in the company.

Wankie had four underground operations in the past, but operated only the No. 3 Mine in 1987. The mine operated in the lower 8 feet of a 41-foot-thick coal seam, mining only 40% of the bottom 8 feet. The bottom part of the coal seam was lower in phosphorus and sulfur and thus had better coking quality. Coal from the underground mine was made into coke nearby and then shipped to the Zimalloy ferrochromium smelter and the ZISCO steel mill. The mine produced approximately 720,000 tons of coal in 1987, but will increase production to 1 million tons in the near future.

Wankie had five open pit operations in the past, but operated only one in 1987. It removed 82 feet of overburden to mine 41 feet of coal. Although the bottom 8 feet of coal was metallurgical quality, the entire seam was utilized for steam coal. The steam coal was chiefly used at Zimbabwe's 920-megawatt powerplant nearby. Other markets included the cement, mining, and tobacco industries. Small amounts of coal were shipped to Botswana, Malawi, Mozambique, and Zambia.

Coke.—Work on the brick relining of the Wankie coke ovens began early in 1987 after dismantlement in late 1986. The coke ovens, east of the Wanga Village, were to be completely rejuvenated by yearend. The

ovens were slated to produce 15,000 tons of coke per month. Four coke byproducts were slated for production: ammonium liquors, benzole, naphthalene, and tar. Only benzol and tar were to be sold as no known markets existed for ammonium liquors and naphthalene.

Petroleum.—Seismic studies were made on the southern side of the Zambezi River Valley to test for viable oil deposits. It was the first time that hydrocarbon exploration was attempted in the area.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Zimbabwean dollars (ZD) to U.S. dollars at the rate of ZD1.66=US$1.00.

The Mineral Industry of Other Central African Countries

By Thomas O. Glover[1]

CONTENTS

CAMEROON

Economic growth in Cameroon was restricted during 1987 owing to a decrease in oil prices during 1986 and the falling value of the U.S. dollar in 1987. The yearly budget reflected a significant drop in revenues and expenditures. Taxes on imports and some exports were increased to raise revenue. The shortage of revenue and the lack of liquidity had restricted the Government's operation and investment programs. External public debt reached an estimated $3.2 billion[2] representing 20.3% of the estimated gross domestic product (GDP) of $12.3 billion. The Government operated at an 8.7% deficit in 1987. The GDP growth rate had fallen to 0.6% in 1987 and was projected to remain at that level in 1988. Economic planning was managed through a series of 5-year plans. The country was under the sixth 5-year plan, which would end in 1991. The plan stressed balanced development as one method to achieve the desired results. Sources of revenue for the year included direct and allied taxes (31.2%), customs collections (31.0%), and oil royalties (23.0%). The oil royalties in 1987 represented a larger part of the budget than in 1986.

In January 1987, eight African oil exporting countries, including Cameroon, formed the African Petroleum Producers' Association (APPA). The eight countries represented about 80% of the total African oil production of 5.2 million barrels per day in 1987. Cameroon produced approximately 3% of total APPA oil production. Cameroon produced approximately 63.5 million barrels of crude oil in 1987, slightly less than that produced in 1986. Earnings also fell in 1987, not only from falling production, but also from declining oil prices and the fall in value of the U.S. dollar on world markets. Oil had been the main stimulus of Cameroon's growth throughout the past decade, and a key generator of export revenues and financial resources for the economy.

Cameroon's remaining recoverable oil reserves at yearend 1987 stood at 352 million barrels. Failing new discoveries, the country could lose its status as an oil producer by the mid-1990's.

Substantial quantities of natural gas have been discovered in Cameroon but not exploited owing to lack of demand and low world prices. Plans for a multibillion dollar liquefied natural gas plant near Kribi in southwestern Cameroon have been shelved

temporarily. Major international oil companies that have been involved in Cameroon's offshore petroleum exploration and development efforts included Shell Oil Co., Mobil Oil Co., and Société Nationale Elf Aquitaine. Cameroon's oil refinery, with a capacity of 2 million tons of crude oil per year, commenced operations in 1981 and supplied the domestic market for refinery products other than asphalt, lubricants, and specialty products.

Other minerals have been discovered in Cameroon in past years, but most have never been exploited. Among those were bauxite, diamond, iron ore, kyanite, and nickel. Cameroon produced cement, gold, limestone, marble, pozzolana, sand, and tin ore. A new lightweight gold dredging unit, developed by the Bureau de Recherches Géologiques et Minières in France, had been put into operation on the Lom River in Cameroon. The aluminum smelter at Edea, supplied with Guinean alumina, produced an estimated 72,431 tons of aluminum in 1987. An estimated 734,000 tons of cement was produced at its Bonfaberi and Figiul plants in 1987. All materials to make the cement were produced locally.

Table 1.—Other countries of Central Africa: Production of mineral commodities[1]

Country[2] and commodity[3]	1983	1984	1985	1986[p]	1987[e]
CAMEROON					
Aluminum metal, primary—metric tons	77,400	73,100	90,296	83,810	72,400
Cement, hydraulic[4]—do.	610,000	NA	748,858	783,368	734,000
Gold, mine output, Au content—troy ounces	261	[e]250	249	246	250
Petroleum, crude[e]—thousand 42-gallon barrels	42,000	56,000	49,000	53,000	63,500
Pozzolana—metric tons	NA	NA	105,634	168,425	170,000
Stone:					
Limestone—do.	50,675	NA	96,961	78,260	80,000
Marble—do.	NA	251,600	1,432	331	300
Tin ore and concentrate:					
Gross weight—do.	NA	14	13	NA	12
Sn content[e]—do.	NA	10	10	NA	9
CENTRAL AFRICAN REPUBLIC					
Diamond:					
Gem—carats	229,681	235,589	189,545	258,701	[5]303,769
Industrial stones—do.	65,677	101,562	87,452	98,677	[5]108,455
Total—do.	295,358	337,151	276,997	357,378	[5]412,224
Gold—troy ounces	2,492	6,953	6,033	7,041	[5]6,605
CONGO					
Cement, hydraulic—metric tons	[r]28,423	[r e]45,000	57,700	[e]58,000	[5 e]38,449
Copper, mine output, Cu content—do.	35	[r e]135	253	[e]250	[5]726
Gas, natural:					
Gross[e]—million cubic feet	13,000	13,000	13,000	13,000	13,000
Marketed[e]—do.	350	350	350	350	350
Gold, mine output, Au content[e]—troy ounces	267	101	515	[r]168	150
Lead, mine output, Pb content—metric tons	4,000	1,740	1,460	[e]1,400	1,400
Lime—do.	--	7,061	[e]7,000	[e]7,000	7,000
Petroleum, crude—thousand 42-gallon barrels	40,271	44,911	43,564	43,435	[5]43,800
Zinc, mine output, Zn content[e]—metric tons	3,000	2,780	2,336	2,300	2,300

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

[1]Includes data available through July 8, 1988.

[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, sand and gravel, and stone) 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, sand and gravel, and stone) presumably are produced, but output is not reported quantitatively, and available information is inadequate to make reliable estimates of output levels.

[4]Includes imported clinker.

[5]Reported figure.

[6]Production includes July-Dec. 1987 only.

CENTRAL AFRICAN REPUBLIC

The Central African Republic (CAR) has made slow progress toward economic development since its independence from France in 1961. Despite recent progress toward economic reform, the CAR remained one of the world's poorest countries. The country's annual per capita income was $337 in 1987. During September 1987, France gave the CAR $15.5 million in financial aid.

The CAR was essentially an agrarian economy; agriculture accounted for 40% of the gross national product (GNP). Mining, manufacturing, and construction, accounted for approximately 15% of the GNP. Economic reforms have been ongoing for 2 years, since political reform began. In keeping with free market policies of the new economic reform program, import and price controls were lifted in 1986 and 1987. A new liberal investment code was expected to go into effect early in 1988. The CAR participated in the monetary union of Francophone Africa, which guaranteed it a fully convertible currency (50 Communauté Financiere Africaine (CFA)=1 French franc). The economy was supported by loans from the International Monetary Fund (IMF) and the International Bank for Reconstruction and Development (World Bank) as well as many loans and grants from other countries. The CAR's financial liquidity problems were so monumental that roughly only 11% of national liquidity remained available to the economy after governmental expenditures and debt services were paid.

Although satellite resource surveys indicated the presence of other minerals, the mining industry in the CAR was dominated by diamond mining. Production of diamonds for legal exporting markets increased after five separate export tax reductions on diamonds. The quantity and quality of diamonds exported since the export tax was lowered to 5% in 1987 have improved considerably. An alluvial diamond mining operation was scheduled to commence production in March 1988. The new company, African Star Mining S.A., a subsidiary of the O'Hair Agency (United States) had mining sites 45 kilometers south of Carnot, which is 540 kilometers west of the capital at Bangui. The mining company had two permits covering 200 square kilometers. The mining operation was scheduled to be completely mechanized, where in prior mining it was worked manually by artisan miners.

CHAD

The production of minerals, which was never large by world standards, ceased to exist after 1980. The Chadian Government and its populace have been involved in internal strife and external intervention since 1965. Natron, a hydrous sodium carbonate, was produced in 1980 as a form of salt that was used domestically. The mining site was near Bol in the Lake Chad area.

Following military victories over Libya in 1987, all military action had apparently ceased and for the first time since 1965 peace had come to Chad. The Chadian Government by the end of 1987 controlled all of Chad except for the disputed Aozou Strip that the Libyans have held since 1973.

Chad was not a petroleum producer in 1987, even though earlier exploration reports indicated a small reserve of oil in the Lake Chad area. If exploited, these reserves were believed to be sufficient to meet domestic needs. Chad's entire annual consumption of petroleum products had been estimated to be less than 24 million gallons. The expense of producing oil for domestic uses, coupled with the cost of building a refinery to process the crude oil, may make the refinery building program financially unfeasible in the near future.

CONGO

The economy of the People's Republic of the Congo in 1987 continued to deteriorate further than that of 1986. The decline was blamed on falling oil prices, depreciation of the dollar, and the country's burdensome debt service. After slashing the 1986 budget by 40%, the 1987 budget had to be reduced by an additional 22%. Deficits remained a problem throughout the year. Economic activity outside the petroleum sector continued to stagnate or decline. Prior to 1987, most of the industrial sector was operated

by parastatals that had become inefficient and indebted. In 1987, the Government opened up several parastatals for privatization. Several others were abolished.

The Congolese economy remained heavily dependent on trade, with petroleum accounting for over 90% of all exports. The United States was the major importer of Congolese oil during 1987. Two U.S. petroleum companies, Amoco Oil Co. and Continental Oil Co., were engaged in exploration during 1987 in the Congo. Elf-Congo Oil Co. and Azienda Generali Italiana Petroli S.p.A., brought in the Tchibouela Field in December 1987. This was the Congo's fifth oilfield discovered and brought into production. Congo, Africa's fifth largest oil producing country, produced 43.8 million barrels of oil in 1987, slightly more than in 1986. Hydro-Congo, the state petroleum company, opened additional acreage for bidding during late 1987, including the onshore Kayes area. Congo's probable oil reserves amounted to 6 billion barrels.

In January 1987, Congo, along with seven other African oil exporting countries, formed the APPA. Congo produced approximately 3% of the total APPA oil production.

Although the nonfuel minerals sector offered considerable potential, it remained largely unexploited. Recent metals production had been limited to one lead-zinc-copper mine at M'Fouati, owned by Société Minière de Mapassa, a state-owned company. In addition, scattered artisanal production of gold was reported. The Congo possessed approximately 1 billion tons of iron ore resources in the High Ivingo area. A joint venture with Gabon had been discussed concerning the exploitation of these deposits. The current glutted international markets and the scarcity of capital made development of these reserves uneconomical. A study by the United Nations had identified offshore phosphate deposits with reserves estimated at 4.5 million tons.

A cement plant that commenced operation in 1985 and closed in 1986 was reopened again in July 1987. The plant was the Congo's only cement producer. A 50% interest in the plant had been purchased for $3.1 million by an international cement company that was jointly owned by Norway's Aker Norcem and Sweden's Euroc. The Congolese cement company was named Socico and had a production capacity of 300,000 tons per year.

EQUATORIAL GUINEA

Equatorial Guinea continued to have economic problems in 1987. Total official debt rose by approximately 12% from 1982 to 1985, with most of the debt accrued by the Government since 1980.

Spain has loaned the Government $5.56 million to be used in refinancing the Guinextebank. The bank's debt amounted to the full amount of the loan. The Banco Exterior de España has held 50% of the share of the Equatorial Guinea Bank. The Government transferred the proceeds of the loan to the bank under the same low-interest, long-term repayment schedule that was negotiated with Spain.

Petroleum exploration has been planned for 1988. Seismic work and drilling operations were planned. The 2,230-square-kilometer Rio Muni permit was shared by Elf Aquitaine Equatorial Guinea (France), Azienda Generali Italiana Petroli S.p.A. Africa Ltd. (Italy), Britoil Co. Ltd. (United Kingdom), Murphy Equatorial Guinea Oil Co. (United States), Rimrock Offshore Ltd. (United States), and Ultramar Exploration Co. Ltd. (United Kingdom).

SAO TOME E PRINCIPE

São Tomé e Principe are two small islands 82 miles apart in the Gulf of Guinea. The total land area of both islands is 370 square miles. They have a population of approximately 114,000 with an average annual growth rate of 2.89%. The labor force totaled approximately 21,000 workers, mostly involved in subsistance farming and fishing. The only mining operations were small clay and stone open pit mines for local construction purposes.

The Organization of Petroleum Exporting Countries fund for international development loaned the Government $1 million for balance of payments support. The loan was for 8 years and was the sixth such loan to São Tomé e Principe. Four of the six loans have been for the same reason. An unsuccessful coup attempt was reported on March 8, 1987.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Communauté Financiere Africaine francs (CFAF) to U.S. dollars at the rate of CFAF300.0=US$1.00.

The Mineral Industry of Other East African Countries

By Kevin Connor[1]

CONTENTS

BURUNDI

Exports of agricultural products, mostly coffee, continued to account for more than 90% of Burundi's foreign exchange revenue. The country's ban on commercial mining was lifted in 1987. Mining of peat for fuel, limestone for agriculture, and clay for insecticides continued as in previous years. At yearend, Burundi's external debt stood at almost $700 million.[2]

Amoco Burundi, a subsidiary of the Amoco Petroleum Co., drilled two exploration wells in northern Lake Tanganyika in 1987. No oil was found, but preliminary findings were encouraging enough that further seismic surveys and offshore and onshore drilling exploration were planned in 1988. Any oil or gas finds would have substantial impact on the Burundian economy because a major portion of the country's trade deficit was directly attributable to petroleum and gas imports. The Zaire Government agreed in June to let Amoco Burundi explore Zaire's side of Tanganyika using the same equipment and personnel being used in Burundi.

The Musongati nickel laterite project remained a most important mining venture but investigations were at a virtual standstill. Analyses and reports on exploration drilling in 1985-86 were offered to various governments, international lending agencies, and mining companies in hopes of generating development capital. The feasibility project consultant, Exploration und Bergbau of the German Democratic Republic, released details on the extent and content of the higher grade nickel deposits in 1986. More than 200 million tons of nickel ore had been estimated in Burundi by yearend, with a high-grade nickel zone identified at Buhinda, northeast of Musongati.[3]

Within the explored high-grade Buhinda area, reserves at a cutoff grade of 0.8% nickel were placed at 29 million tons averaging 1.62% nickel, 0.12% cobalt, and 0.31% copper. The ore also contained palladium and platinum. Approximately 46% of the ore was ferrolitic, and the rest was higher valued saprolite. Drilling evidence suggested a coherent 1,200-meter-long by 200-meter-wide mineralized zone, characterized by thick, saprolitic, high-grade nickel

ore. The shallow ore body was described to have overburden ranging from 5 to 55 meters, with an average of approximately 21 meters.

Table 1.—Other countries of East Africa: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Country and commodity	1983	1984	1985	1986[p]	1987[p]
BURUNDI[2]					
Clays: Kaolin	4,053	1,990	4,360	5,113	5,290
Gold troy ounces	272	1,115	829	980	836
Lime	300	42	1,100	160	137
Peat	13,293	14,000	10,313	12,455	17,000
ETHIOPIA[2]					
Cement, hydraulic[e]	170,000	240,000	250,000	250,000	250,000
Clays: Kaolin[e]	9,000	9,000	9,000	9,000	5,000
Gold, mine output, Au content[e] troy ounces	14,000	15,000	15,000	15,000	[3]20,651
Gypsum and anhydrite, crude[e] cubic meters	4,000	4,000	4,000	4,000	935
Petroleum refinery products:[e]					
Gasoline thousand 42-gallon barrels	[3]855	900	[3]849	850	850
Kerosene and jet fuel do.	[3]465	500	[3]478	500	500
Distillate fuel oil do.	[3]1,514	1,500	[3]2,149	2,100	2,100
Residual fuel oil do.	[3]2,033	2,000	[3]1,377	1,400	1,400
Other do.	[3]146	150	[3]122	125	125
Refinery fuel and losses do.	[3]475	500	[3]544	550	550
Total do.	[3]5,488	5,550	[3]5,519	5,525	5,525
Platinum, mine output, Pt content[e] troy ounces	125	125	150	150	150
Pumice[e] cubic meters	[3]5,625	6,000	6,000	6,000	26,042
Salt:[e]					
Rock	15,000	15,000	15,000	15,000	15,000
Marine	110,000	120,000	120,000	120,000	120,000
Stone, sand and gravel:[e]					
Limestone	100,000	100,000	100,000	100,000	125,000
Sand cubic meters	650,000	650,000	650,000	650,000	422,601
Other	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
KENYA[2]					
Barite	300	210	255	420	50
Carbon dioxide, natural	3,000	3,161	3,151	4,093	4,386
Cement, hydraulic thousand tons	1,280	1,164	847	1,312	1,321
Clays:					
Bentonite[e]	200	200	200	200	200
Kaolin	650	295	320	2,000	40
Diatomite	1,570	1,512	3,082	1,450	616
Dolomite[e]	[3]1,920	[3]2,865	3,000	3,000	3,000
Feldspar	700	685	692	--	500
Fluorspar	59,084	46,578	58,174	50,851	60,190
Gem stones, precious and semiprecious:					
Amethyst kilograms	5	17	10	(4)	(4)
Aquamarine do.	4	7	7	(4)	(4)
Garnet do.	68	107	90	44	408
Ruby do.	98	187	92	66	70
Sapphire grams	[r]5,000	[r]5,000	[r]5,000	[r]5,000	5,000
Tourmaline kilograms	37	13	31	5	11
Gold, mine output, Au content troy ounces	100	600	442	2,339	8,939
Gypsum and anhydrite	1,350	[e]1,500	[e]1,500	11,060	38,819
Iolite grams	5,504	23,000	24,000	20,000	[e]20,000
Iron and steel: Steel, crude[e]	10,000	10,000	10,000	10,000	10,000
Kyanite kilograms	5,447	1,000	1,000	1,000	1,000
Lime	34,869	20,855	27,860	12,300	26,482
Magnesite[e]	300,000	[3]311,254	300,000	300,000	300,000
Petroleum refinery products:[e]					
Gasoline, motor thousand 42-gallon barrels	2,555	2,600	2,600	2,600	2,600
Jet fuel do.	2,555	2,600	2,600	2,600	2,600
Distillate fuel oil do.	3,285	3,300	3,300	3,300	3,300
Residual fuel oil do.	4,015	4,000	4,000	4,000	4,000
Unspecified do.	365	400	400	400	400
Refinery fuel and losses do.	365	400	400	400	400
Total do.	13,140	13,300	13,300	13,300	13,300
Phosphatic materials: Guano	--	6	6	--	--
Salt:					
Rock	[e]60,000	72,885	66,330	65,000	[e]65,000
Other	[e]23,427	28,000	25,800	35,379	[e]35,000
Total	83,427	100,885	92,130	100,379	[e]100,000
Shale	231,069	789,484	750,000	750,000	142,428

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	1983	1984	1985	1986[p]	1987[p]
KENYA[2] —Continued					
Sodium compounds, n.e.s.:					
Soda ash	193,690	226,050	227,760	237,650	228,650
Soda, crushed, raw	4,260	5,288	5,441	5,882	1,557
Stone, sand and gravel:					
Calcareous:					
Coral (for cement manufacture)	150,000	150,000	150,000	175,030	e175,000
Kunkur (for cement manufacture)e	200,000	200,000	230,000	250,000	250,000
Limestone (for cement manufacture)	1,579,960	1,444,234	1,333,000	2,069,020	e2,000,000
Sand, glass	r5,488	r5,550	5,519	5,525	e5,525
Vermiculite	1,200	872	1,515	2,544	3,887
Wollastonite	--	--	--	298	e300
LESOTHO[2]					
Stonee cubic meters	25,000	25,000	25,000	25,000	25,000
MALAWI[2]					
Cement, hydraulic	70,318	70,058	61,654	69,471	72,831
Coal	--	2,000	e4,000	10,708	18,256
Lime	2,190	2,005	1,923	2,735	3,160
Stone: Limestone	109,186	e100,000	e100,000	103,037	107,040
MAURITIUS[2]					
Limee	7,000	7,000	7,000	7,000	7,000
Salte	6,000	6,000	6,000	6,000	6,000
Stone: Basalt, not further describede	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000
MOZAMBIQUE[2]					
Asbestos	e600	e400	55	--	--
Bauxite	--	--	5,037	4,247	e5,000
Beryllium: Beryl concentrate, gross weight	6	7	6	e6	e6
Bismuth	3,509	1,047	1,052	80	e100
Cement, hydraulic thousand tons	3420	450	450	450	450
Clays:					
Bentonite	250	405	361	1,112	e1,100
Kaolin	292	e300	152	200	e200
Coal, bituminous thousand tons	59	107	20	50	e50
Copper, mine output, salable ore and concentrate:					
Gross weight	1,189	1,573	590	1,303	e1,000
Cu content	250	291	118	260	e200
Feldspar	817	e800	67	100	e100
Gem stones:					
Aquamarine grams	2,246	2,400	3,600	3,600	e3,600
Beryl, morganite do.	28	96	50	50	e50
Emerald do.	3,531	4,200	5,000	5,000	e5,000
Garnet kilograms	1,268	1,625	1,500	11,024	e10,000
Tourmaline grams	1,597	6,000	1,500	1,238	e1,200
Lime, hydraulice	10,000	10,000	10,000	10,000	10,000
Marble cubic meters	406	575	715	1,137	e1,100
Mica, wastee	3309	300	300	300	300
Microlite kilograms	23,000	9,900	6,283	2,649	e3,000
Monazite concentrate do.	34,141	4,000	4,000	4,000	e4,000
Ornamental stones, rose quartz do.	4,911	3,600	2,500	2,500	e2,500
Petroleum refinery products:e					
Gasoline thousand 42-gallon barrels	3637	3140	175	175	175
Kerosene and jet fuel do.	3162	323	50	50	50
Distillate fuel oil do.	3454	160	250	250	250
Residual fuel oil do.	3652	3487	500	500	500
Asphalt do.	311	325	25	25	25
Totale do.	31,916	3835	1,000	1,000	1,000
Salt, marinee	28,000	28,000	28,000	28,000	28,000
Tantalum ores and concentrates, tantalite kilograms	13,900	6,700	4,275	2,724	e3,000
RWANDA[2]					
Beryllium: Beryl concentrate, gross weight	32	44	27	--	--
Columbite-tantalite, ores and concentrates, gross weight	50	52	28	--	--
Gold, mine output, Au content troy ounces	623	240	238	208	325
Tin:					
Mine output, Sn content	1,068	1,093	813	29	--
Smelter output, Sn content	1,110	1,000	800	--	--
Tungsten, mine output, W content	231	260	167	13	--
SEYCHELLES[2]					
Guanoe	4,500	4,500	4,500	4,500	4,500

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	1983	1984	1985	1986[p]	1987[p]
SOMALIA[2]					
Salt, marine[e]	30,000	30,000	30,000	30,000	30,000
Sepiolite, meerschaum[e]	10	10	10	10	10
SUDAN[2]					
Cement, hydraulic thousand tons	[e]200	176	193	200	122
Chromium: Chromite concentrate, gross weight[e]	20,000	20,000	8,799	8,500	13,015
Gold, mine output, Au content[e] troy ounces	500	1,500	1,500	1,600	[3]2,734
Gypsum and anhydrite, crude[e]	8,000	8,000	6,400	7,000	7,000
Manganese ore[e]	400	400	400	400	400
Mica, all grades[e]	[3]10	[3]10	10	10	10
Petroleum refinery products:[e]					
Gasoline thousand 42-gallon barrels	1,000	772	1,000	1,000	1,000
Jet fuel do.	300	334	300	300	300
Distillate fuel oil do.	2,000	1,438	1,500	1,500	1,500
Residual fuel oil do.	2,000	1,690	1,500	1,500	1,500
Refinery fuel and losses do.	300	44	300	300	300
Other do.	--	216	--	--	--
Total do.	5,600	4,394	4,600	4,600	4,600
Salt	[e]75,000	[e]75,000	38,467	[e]40,000	51,662
SWAZILAND[2]					
Asbestos: Chrysotile	26,287	25,832	25,130	20,908	25,925
Coal: Anthracite	101,652	124,569	166,179	172,145	165,317
Diamond carats	--	16,837	21,128	39,144	[e]95,000
Stone: Quarry product cubic meters	151,468	97,657	83,903	120,723	96,114
Tin, mine output, Sn content	5	1	--	--	--
TANZANIA[2]					
Cement, hydraulic thousand tons	420	370	301	[e]300	[e]300
Clays:					
Bentonite	[3]75	[3]75	75	[e]75	[e]75
Kaolin	1,276	1,885	1,636	[e]1,600	[e]1,600
Coal, bituminous	9,996	9,722	20,000	[e]20,000	[e]20,000
Diamond[5] carats	260,574	277,352	236,000	190,000	150,000
Gem stones, precious and semiprecious excluding diamond:[e 6]	[3]646	650	[3]646	650	650
Gold, refined troy ounces	[e]800	2,680	1,776	2,735	[e]3,000
Gypsum and anhydrite, crude[e]	12,000	12,000	[3]14,411	14,000	14,000
Lime, hydrated and quicklime[e]	[3]3,006	3,000	[3]2,472	3,000	3,000
Mica, sheet	([4])	([4])	([4])	([4])	([4])
Nitrogen: N content of ammonia[e]	6,000	6,000	6,000	6,000	6,000
Petroleum refinery products:[e]					
Liquefied petroleum gas thousand 42-gallon barrels	[3]54	[3]63	80	80	80
Gasoline do.	[3]718	[3]892	800	800	800
Kerosene do.	[e]200	[3]259	220	220	220
Jet fuel do.	[3]174	[3]213	300	300	300
Distillate fuel oil do.	[3]914	[3]1,062	1,050	1,050	1,050
Residual fuel oil do.	[3]1,317	[3]1,904	1,750	1,750	1,750
Refinery fuel and losses do.	[3]290	[3]330	300	300	300
Total[e] do.	[3]3,667	[3]4,723	4,500	4,500	4,500
Phosphate minerals: Apatite	[e]20,000	14,536	15,000	10,000	18,400
Salt, all types	28,297	21,659	21,108	21,868	[e]22,000
Soda ash	--	298	300	[e]300	300
Tin, mine output, Sn content	6	4	2	[e]2	[e]2
UGANDA[2]					
Cement, hydraulic[e]	20,000	20,000	20,000	20,000	20,000
Lime, hydrated and quicklime[e]	[3]413	500	500	500	500
Phosphate minerals: Apatite[e]	100	100	100	100	100
Salt, evaporated[e]	5,000	5,000	5,000	5,000	5,000
Tin, mine output, Sn content	[r]18	[r e]18	[r e]18	[r e]18	10
Tungsten, mine output, W content[e]	[3]4	[3]4	4	4	4

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

[1]Includes data available through Sept. 8, 1988.

[2]In addition to the commodities listed, modest quantities of unlisted varieties of crude construction materials (clays, sand and gravel, and stone) presumably are produced, but output is not reported quantitatively, and available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

[4]Less than 1/2 unit.

[5]Diamond figures are estimated to represent 70% gem-quality or semigem-quality and 30% industrial-quality stones.

[6]Exports.

COMOROS

There were no known commercially exploitable mineral deposits on the islands of the Comoros archipelago, and only small sand and gravel excavations for local construction were operated during the year. The Islands continued to rank among the world's poorest nations. The country's principal foreign-exchange earners were vanilla and cloves.

DJIBOUTI

Mineral production in Djibouti during the year was limited to locally used construction materials, evaporated salt, and a small amount of lime. The Hanle-Gaggade phase 1 geothermal project continued, with Pool-Intairdril of the United States selected to drill four exploration geothermal wells. Drilling began in December 1986 at Hanle, 50 kilometers southeast of the Ethiopian border. The wells were drilled over a 1-year period, and ranged in depth from approximately 2,300 meters to 2,500 meters. The value of the drilling contract was estimated at $6 million.[4]

The Italian company Aquater, a subsidiary of the State agency Ente Nazionale Idrocarburi (ENI) and a consultant on the geothermal project, was conducting a detailed analysis of the well data to determine the area's geothermal reserves. Potentially all of Djibouti's electrical demands could be met with geothermal energy. The total phase-1 cost, which covered both the drilling and analysis, was estimated at $16.6 million and was being funded by IDA, the Government of Italy, the African Development Bank, the Organization of Petroleum Exporting Countries Fund for International Development, and the United Nations Development Program (UNDP).

ETHIOPIA

Mineral production in Ethiopia continued to be a small part of the economy. Small amounts of gold, kaolin clay, marble, and platinum were produced for export while gypsum, limestone, marble, and salt were produced for domestic consumption. Gold was by far the major mineral export in terms of value, worth approximately $8 million[5] in revenues in 1987. All petroleum related requirements continued to be imported, with crude being refined at the country's sole refinery at Assab.

The gold activity in Ethiopia centered around the Adola placer deposits in southern Ethiopia in Sidamo Province. The Government put considerable emphasis on increasing the production of gold, with technical and equipment assistance from the U.S.S.R. The Government hoped to increase annual production to 100,000 troy ounces over the course of the next few years.

The Bureau de Recherches Géologiques et Miniéres (BRGM) of France and Seltrust Engineering of London, United Kingdom, completed a final feasibility study on development of the Lega Denbi gold deposits in southern Ethiopia. Based on the results of the study, development of a surface mine was under way at yearend. As part of the construction, a contract to build a 3,000-ton-per-day conventional cyanide leaching and associated processing plant was awarded to Davy McKee Corp. of Stockton, United Kingdom. Gold production was expected to begin in 1989, and startup of the processing plant was expected to begin in 1990. A $23 million credit from the African Development Bank was secured for the project in November, and another loan of approximately $25 million was being negotiated with the European Investment Bank at yearend.

Mining of marble and its use as a local building material and export commodity continued to grow in 1987. A quarrying operation for marble, granite, and limestone was developed by the Government in the Dalatti area, northwest of Mendi in western Wellega, approximately 600 kilometers from Addis Ababa. The deposits

were discovered in the late 1970's, and commercial operations began in 1981. The Ethio-Libyan Joint Mining Co., formed in 1981, was the quarry operator, owned 51% by the Government of Ethiopia and 49% by the Government of Libya. In 1985, further deposits of marble were delineated in the Mendi area, with total estimates for the area approaching 1 million tons of reserves.

Work continued on development of an open pit for potash in the Danakil Depression in northern Ethiopia, but insurgents were hampering progress. The Ethiopian-Libyan Mining Co. contracted with Entreprise Miniére et Chimique S.A. of France, to design and supervise the construction of a 1.5-million-ton-per-year open pit and beneficiation plant, based on approximately 70 million tons of proven potassium chloride reserves in the western Danakil area. Start-up was not expected until after 1990.

Table 2.—Ethiopia: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1984	1985	Principal destinations, 1985
Asbestos	--	4	All to Djibouti.
Cement	--	6	Do.
Copper: Metal including alloys, scrap	--	52	All to United Kingdom.
Iron and steel: Metal, semimanufactures: Bars, rods, angles, shapes, sections	5	--	
Petroleum refinery products: Residual fuel oil thousand 42-gallon barrels	1,143	1,502	Yemen (Aden) 1,028; Sudan 267; Yemen (Sanaa) 200.
Salt and brine	16,152	33,600	Malaysia 24,000; Kenya 5,000; Tanzania 4,000.

[1]Table prepared by Virginia A. Woodson. Ethiopia did not report any exports of mineral commodities to the United States during 1985.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	15	6	--	All from United Kingdom.
Metal including alloys, semimanufactures	444	348	--	Belgium-Luxembourg 143; West Germany 50; France 48.
Copper:				
Matte and speiss including cement copper	2	--		
Metal including alloys, semimanufactures	375	75	38	East Germany 10; West Germany 10.
Iron and steel: Metal:				
Scrap	640	1,296	--	Yemen (Aden) 961; Sudan 79.
Pig iron, cast iron, related materials	38	2	--	East Germany 1; U.S.S.R. 1.
Ferroalloys:				
Ferromanganese	103	--		
Unspecified	--	54	--	All from West Germany.
Steel, primary forms	6,216	8,626	--	Poland 4,747; Japan 3,483.
Semimanufactures:				
Bars, rods, angles, shapes, sections	12,291	9,627	--	Romania 2,344; West Germany 2,235; United Kingdom 2,063.
Universals, plates, sheets	31,314	19,444	36	Japan 12,365; West Germany 2,863.
Hoop and strip	2,635	3,713	--	Japan 3,583.
Rails and accessories	74	12	--	United Kingdom 4; France 3.
Wire	1,798	809	--	Republic of Korea 528; Japan 127.
Tubes, pipes, fittings	12,563	5,510	23	West Germany 1,622; U.S.S.R. 1,296; India 1,008.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS —Continued				
Lead:				
Oxides	4	2	--	All from United Kingdom.
Metal including alloys:				
Scrap	244	--		
Unwrought	26	1	--	Do.
Semimanufactures	NA	39	--	Italy 30; Japan 6.
Manganese: Oxides	100	123	--	All from Switzerland.
Mercury 76-pound flasks	--	29	--	All from West Germany.
Nickel:				
Matte and speiss	(2)	1	--	All from Italy.
Metal including alloys:				
Scrap value, thousands	$2	$3	--	All from Japan.
Unwrought	3	2	--	All from Italy.
Semimanufactures	266	17	--	West Germany 10; United Kingdom 5.
Silver:				
Waste and sweepings value, thousands	--	$3	--	All from Italy.
Metal including alloys, unwrought and partly wrought do.	$14	--		
Tin: Metal including alloys:				
Unwrought	1	--		
Semimanufactures	6	3	--	United Kingdom 2; Sweden 1.
Zinc:				
Oxides	24	47	--	All from West Germany.
Metal including alloys:				
Scrap	110	1,651	--	Japan 1,562; Belgium-Luxembourg 89.
Unwrought	1,500	17	--	All from United Kingdom.
Semimanufactures	1	90	--	All from Japan.
Other:				
Oxides and hydroxides	1,585	15	--	All from West Germany.
Base metals including alloys, all forms value, thousands	$2	--		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Artificial: Corundum	244	394	--	Do.
Grinding and polishing wheels and stones	102	894	--	Denmark 732; France 54.
Asbestos, crude	--	353	--	Italy 350.
Boron materials: Crude natural borates	15	--		
Cement	95,986	568	--	U.S.S.R. 292; Ireland 100.
Clays, crude	827	966	--	West Germany 910.
Diatomite and other infusorial earth	--	10	--	All from France.
Fertilizer materials:				
Crude, n.e.s value, thousands	$3,039	--		
Manufactured:				
Ammonia	11	6	--	All from West Germany.
Nitrogenous	15,116	29,615	--	Republic of Korea 25,200; Netherlands 2,560.
Phosphatic	23,732	500	--	West Germany 300; Belgium-Luxembourg 200.
Unspecified and mixed	36,084	28,484	--	Republic of Korea 26,250; United Kingdom 1,417.
Lime	798	8	--	All from Belgium-Luxembourg.
Magnesium compounds, unspecified	80	100	--	All from Netherlands.
Mica: Worked including agglomerated splittings value, thousands	$1	--		
Pigments, mineral: Iron oxides and hydroxides, processed	52	--		
Salt and brine	18	11	NA	West Germany 1; unspecified 8.
Sodium compounds, n.e.s.:				
Carbonate, natural and manufactured	2,082	863	--	Kenya 500; West Germany 346.
Sulfate, manufactured	4,603	4,063	--	West Germany 2,594; Italy 826; Kenya 500.
Stone, sand and gravel:				
Dimension stone: Crude and partly worked	16	--		
Dolomite, chiefly refractory-grade	258	52	--	All from Italy.
Gravel and crushed rock	112	--		
Limestone other than dimension	300	--		
Sand other than metal-bearing	9	2	--	All from Netherlands.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur:				
Elemental:				
Crude including native and by-product	4	19	--	All from West Germany.
Colloidal, precipitated, sublimed	403	1,237	--	West Germany 1,137.
Sulfuric acid	1,396	1,735	--	West Germany 776; Italy 532; U.S.S.R. 253.
Talc, steatite, soapstone, pyrophyllite	56	3	--	All from West Germany.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	516	144	--	West Germany 118; Italy 26.
Coal: Anthracite and bituminous	4	10	--	All from France.
Coke and semicoke	68	--		
Petroleum:				
Crude thousand 42-gallon barrels	5,261	5,456	--	All from U.S.S.R.
Refinery products:				
Liquefied petroleum gas 42-gallon barrels	81	--		
Gasoline, motor do.	27,893	315	--	All from Djibouti.
Mineral jelly and wax do.	5,194	7,327	87	Netherlands 4,966; West Germany 2,140.
Kerosene and jet fuel do.	3,255	318	--	Netherlands 248; Djibouti 70.
Distillate fuel oil do.	242,525	612	--	Djibouti 336; France 231.
Lubricants do.	96,936	93,478	--	United Kingdom 48,097; Italy 28,665; Netherlands 11,102.
Residual fuel oil do.	36,131	266	--	All from United Kingdom.

NA Not available.
[1]Table prepared by Virginia A. Woodson.
[2]Unreported quantity valued at $1,000.

KENYA

Increased international crude oil prices and depressed coffee prices combined to reverse the promising economic trends Kenya experienced in 1986, when inflation was reduced to 4.5%. Although all external debts were met in 1987, the foreign-exchange reserves of the country fell sharply, and the Government responded by imposing heavy restrictions on imports. The Kenyan trade balance for 1987 was a deficit of almost $650 million.[6]

Other than stepped-up gold exploration, there was little change in the minerals sector. Depressed international prices for most industrial minerals was the major reason for lack of activity.

Bamburi Portland Cement Co. produced over 970,000 tons of cement. Of this figure, 379,000 tons was exported, while the rest was consumed locally. Local sales increased slightly due to the startup of construction of a dam at the base of Mount Elgon; the East African Portland Cement Co. produced a record of just under 326,000 tons. The company requested Government assistance for modernizing and expanding operations to meet the Mount Elgon dam cement requirements.

Magadi Soda Co. produced slightly less than in 1987, but remained Kenya's largest supplier of salt. Its output of 37,000 tons of crude salt was approximately the same level as in recent years. Magadi operations continued to be financially hampered by yearly increases in railroad tariffs and unreliable service, mainly unavailability of locomotives.

The Kenya Fluorspar Co. (KFC) successfully produced low-phosphorus, high-quality fluorspar for the first time during late 1986, and these efforts began to pay off in 1987. Laboratory work in 1985, under contract to Robertson Research International Ltd. of the United Kingdom, resulted in the development of an economically feasible process for reducing phosphorus impurities in KFC's concentrates. The level of impurities had hindered the company's sales since startup in 1975. With a higher quality product, the company found ready markets in the United States, Western Europe, Japan, and Australia.

By the use of various reagents to depress the phosphorus mineral apatite in the flotation circuit, Robertson Research demonstrated that the phosphorus pentoxide content could be lowered to less than 0.10%. The new process included additional concentrate cleaning stages that also reduced silica and carbonate impurities. The requir-

ed changes to the plant's operations were completed in early 1987.

KFC also developed another surface mine at Cheberen in the Kerio Valley. With the additional mine, expectations for KFC's operations in 1988 were 300,000 tons of ore production and 100,000 tons of fluorspar output from the processing plant.

At yearend, gold exploration concessions were held by BRGM, Kenor of Norway, Migori Gold of Kenya, and the San Martin Co. of Switzerland. San Martin continued underground development of a mine on the quartz reef deposits of Western Kenya's Archean greenstone gold belts in the Lake Victoria Basin. Other deposits in western Kenya were being mined on the artisan level.

By yearend, the Metal Mining Agency of Japan (MMAJ) had almost completed the first phase of its project to explore for rare-earth minerals and phosphate in the Homa Bay region of Western Kenya. Initial results were reported to be very encouraging, and the second phase of the estimated 3-year project was expected to begin by mid-1988.

Gem stone exploration continued in 1987, along with mining for tsavorite, a green garnet gem stone found only in Kenya, which continued to gain international recognition.

LESOTHO

Since closure of the Letseng-la-Terai diamond mine in 1982, Lesotho's mineral production consisted solely of sand and gravel for local use. However, a major factor in the economy continued to be repatriated wages of Lesotho mineworkers in the Republic of South Africa.

MALAWI

Mineral production and exploration increased with encouraging signs for further improvement in 1988. The Portland Cement Co. of Malawi increased production about 4%, and sold it all with revenues estimated at $8 million.[7] The Kaziwiziwi coal mine increased production more than 80% in its second full year of production. It sold 18,600 tons valued at $500,000, also more than 80% higher. Further substantial production increases were expected in 1988 with explosives to be used in extracting the coal for the first time, and a rail system to replace wheelbarrows in transporting the coal out of the mine. Lime production, still small-scale, increased approximately 10%, with sales amounting to 2,580 tons at a value of $100,000. An experimental vertical kiln, built by the Government during the year, was expected to improve the quality of the lime. Testing of the kiln was to begin in 1988.

An experimental coal mine opened at Mchenga, approximately 8 kilometers southeast of Kaziwiziwi. The project was being handled by Charbonnage de France under a funding agreement between the Governments of Malawi and France. By the yearend two adits had been driven next to the 1.5-meter-thick seam of interest, and exploratory drilling cores in from the adit were used to estimate a reserve of 1.1 million tons of coal. At yearend, all mining equipment had been installed, and limited mining activities were expected in 1988.

As a followup phase to geological mapping by BRGM and the Malawi Geological Survey Department (GSD), drilling began in the Mwabvi Coalfield of the Nsanje District. By yearend, eight exploration drill holes had been completed. Results showed thick coal seams near the surface, and at moderate depths. Geological mapping by RGM and GSD was also carried out on the North Rukuru and Nthalire Basins in the Chitipa District. A comprehensive exploration drilling program was being planned for North Rukuru, which was estimated to have the potential for the largest coal reserves in Malawi.

Paterson, Grant, and Watson of Toronto, Canada, completed their evaluation of the UNDP funded airborne geophysical survey completed in 1986. Interpretation of the results show a lot of mineralized areas with good potential for base metals, gold, the platinum-group metals, industrial minerals, and radioactive minerals.

MMAJ and the Japan International Cooperation Agency completed the second phase of an exploration of the Tundulu and Songwe carbonatite complexes. Thirty-five drill holes had been completed by the end of the phase, along with sampling from five trenches. Results of the drilling had not been made public by yearend. Phase 3 was to begin in mid-1988.

MAURITIUS

Mauritius continued to advance as a developing country, with a gross domestic product (GDP) of $1.3 billion[s] in 1987. The economy grew by an estimated 7% for the third consecutive year of strong growth. Mineral production comprised only small amounts of salt and lime, along with some sand, gravel, and stone for construction. For the second year since 1974, Mauritius recorded a trade balance surplus, owing mainly to increasing exports of manufactures. Although sugar was the most important export, the manufacturing sector accounted for more than one-half of all export revenues.

MOZAMBIQUE

In January 1987, the Government of Mozambique adopted a Program for Economic Rehabilitation, which included dismantling the country's centralized economic system and replacing it where possible with private control. As part of this plan, large state-run collective farms were returned to private hands during the year. Agriculture employed more than 85% of the work force.

Mozambique's GDP increased almost 20% to about $4.7 billion. However, most balance of payment indicators showed increased deficits, and the country's foreign debt increased about 14% to about $3.6 billion. As in recent years, the country's economy and its ability to attract foreign investors were severely hampered by the insurgency.

A U.S. Government-funded study in 1987 evaluated the economic potential of a number of minerals in Mozambique, including ilmenite, nickel, chromite, cobalt, beryllium, tantalum, rare earths, manganese, platinum, bauxite, graphite, marble, diatomite, bentonite, fluorspar, coal, and natural gas. It was felt that ilmenite (sands) and diatomite showed the best near-term development potential.

Coal output improved dramatically, although the production potential appeared to be very much higher. The Mozambique Government was seeking aid from the German Democratic Republic and the U.S.S.R. to rehabilitate the five existing mines at Moatize. These mines had a combined capacity of 800,000 tons per year. Two new opencast mines were planned for Moatize and described in a preliminary study. These could boost coal production to 6 million tons per year. Because of problems related to the continuing insurgency, including the cutting of the railroad line to the port of Beira, 200,000 tons of coal was stockpiled at yearend. Coal reserves at Moatize were estimated to be 2 billion tons, with an additional 1.5 billion tons estimated in the nearby Sananggoe Basin.

Kenmare Resources PLC (KRPLC) of Dublin, Ireland, and the Geological Survey of Yugoslavia (GEO) signed 50-50 joint-venture agreement to develop a titaniferous mineral sand deposit between the towns of Angoche and Sangage on the northeastern coastline. The deposit was discovered by GEO in the early 1980's, and a 5-year sampling program, including exploration drilling, delineated proven reserves along a 4.5-kilometer strip of 28 million tons of ore grading 8% economic heavy minerals. Concentrates graded 84% ilmenite, 8% titanomagnetite, 4% zircon, 3% rutile, and 1% monazite. Metallurgical testing was under way at yearend, and final results were expected to be reported in early 1988. Preliminary findings indicated a potential recovery rate of between 85% and 90%. Further drilling and engineering studies were under way at yearend, to be completed in early 1988. Given favorable results, commercial production could begin as early as 1989, with KRPLC the operator-manager.

Edlow Resources, a Bermuda-registered company from the United States, began prospecting for titaniferous beach sands in a 200-kilometer-long concession in Zambezia and Nampula Provinces, between Raraga and Moma. Substantial reserves were already known to exist, and Edlow was looking for additional reserves and more information on specific locations. The concession agreement was for 27 years, and the initial project cost was estimated at $20 million. Production could be as early as 1990.

A contract was signed with Lonrho Ltd. of the United Kingdom for exploration and development of gold deposits in Manica Province. Investments by Lonrho in 1987 totaled $2 million.

The Esso Petroleum Co. and Shell Exploration Co. partnership continued its petroleum exploration drilling in Cabo Delgado Province; however, no discovery announcements were made. British Petroleum Co.

signed an agreement in September to spend $31 million in exploration drilling in 1988 and 1989.

REUNION

Mineral activities on the island were limited to small sand and gravel operations for local construction, and operation of a 200,000-ton-per-year year cement clinker grinding plant at Saint-Denis, which manufactured cement mix from imported materials. Réunion, an island of approximately 2,500 square kilometers, had a population of approximately 550,000 in 1987 and remained an overseas department of France.

Table 4.—Réunion: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations (principal), 1986
METALS			
Aluminum: Metal including alloys:			
Scrap	43	58	France 49; Madagascar 9.
Semimanufactures, value, thousands	--	$3	Comoros $1; Mauritius $1.
Copper: Metal including alloys:			
Scrap	138	164	All to France.
Semimanufactures, value, thousands	$1	$2	Comoros $1; Madagascar $1.
Iron and steel: Metal:			
Scrap	2,716	271	Italy 258; France 13.
Semimanufactures:			
Bars, rods, angles, shapes, sections	86	141	Comoros 88; Madagascar 52.
Universals, plates, sheets	700	921	Comoros 471; France 249.
Hoop and strip	1	--	
Rails and accessories	--	1	All to Comoros.
Wire	3	1	Do.
Tubes, pipes, fittings	75	153	Madagascar 106; Comoros 46.
Castings and forgings, rough	1	16	All to France.
Silver: Metal including alloys, unwrought and partly wrought, value, thousands	--	$4	Do.
Titanium: Oxides	--	3	All to Madagascar.
INDUSTRIAL MINERALS			
Cement	4	21	Madagascar 20.
Clays, crude	--	46	All to Madagascar.
Fertilizer materials: Manufactured:			
Ammonia	--	2	All to Republic of South Africa.
Nitrogenous	3	--	
Phosphatic	--	2	All to Comoros.
Unspecified and mixed	6	--	
Sulfur:			
Elemental, crude including native and byproduct, value, thousands	$1	--	
Sulfuric acid	4	--	
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Liquefied petroleum gas, 42-gallon barrels	731	766	Do.
Mineral jelly and wax, do.	--	126	All to Republic of South Africa.
Kerosene and jet fuel, do.	--	62	NA.
Distillate fuel oil, do.	112	--	
Lubricants, do.	511	875	Comoros 777; Madagascar 63.
Residual fuel oil, do.	40	--	

NA Not available.

[1]Table prepared by Virginia A. Woodson. Réunion did not report any exports of mineral commodities to the United States during 1986.

Table 5.—Réunion: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals value, thousands	$2	$1	--	All from France.
Aluminum:				
Oxides and hydroxides ---do---	$1	$7	--	Do.
Metal including alloys, semimanufactures	225	249	--	France 226; Belgium-Luxembourg 14.
Chromium: Oxides and hydroxides	4	--		
Copper: Metal including alloys:				
Unwrought	2	--		
Semimanufactures	257	310	--	France 300.
Iron and steel: Metal:				
Pig iron, cast iron, related materials	5	5	--	All from France.
Semimanufactures:				
Bars, rods, angles, shapes, sections	18,422	28,342	--	Republic of South Africa 11,984; Spain 7,649; France 4,562.
Universals, plates, sheets	18,708	17,025	--	France 12,263; Republic of South Africa 2,608.
Hoop and strip	39	38	--	All from France.
Rails and accessories	652	21	--	Do.
Wire	624	778	--	Republic of South Africa 381; France 257.
Tubes, pipes, fittings	8,223	11,242	--	France 7,297; Republic of South Africa 2,675.
Castings and forgings, rough	398	522	--	France 434; Belgium-Luxembourg 88.
Lead:				
Oxides	9	7	--	All from France.
Metal including alloys, semimanufactures	11	5	--	Do.
Mercury value, thousands	$2	--		
Nickel: Metal including alloys:				
Unwrought ---do---	--	$1	--	Do.
Semimanufactures ---do---	$36	$1	--	All from West Germany.
Silver:				
Waste and sweepings ---do---	--	$2	--	Do.
Metal including alloys, unwrought and partly wrought ---do---	$7	$19	--	Do.
Tin: Metal including alloys:				
Scrap ---do---	$1	--		
Semimanufactures	1	2	--	All from France.
Titanium: Oxides	379	392	--	Do.
Zinc:				
Oxides	8	7	--	Do.
Metal including alloys:				
Unwrought	1	1	--	Mainly from France.
Semimanufactures	8	28	--	All from France.
Other: Oxides and hydroxides	--	898	--	All from Kenya.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	1	10	--	Mainly from France.
Grinding and polishing wheels and stones	39	38	--	France 35.
Asbestos, crude	4	11	--	United Kingdom 6; France 4.
Barite and witherite	220	60	--	All from France.
Boron materials: Oxides and acids	--	1	--	Do.
Cement	248,661	222,462	--	Kenya 128,627; Republic of South Africa 53,546.
Chalk	2,072	1,727	--	France 1,212; Mauritius 515.
Clays, crude	553	35	--	All from France.
Diamond: Gem, not set or strung value, thousands	$13	$27	--	France $19; India $7.
Diatomite and other infusorial earth	25	58	--	All from France.
Fertilizer materials: Manufactured:				
Ammonia	11	8	--	France 5; Belgium-Luxembourg 3.

See footnote at end of table.

Table 5.—Réunion: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Fertilizer materials: Manufactured — Continued				
Nitrogenous	2,495	5,074	--	Italy 3,275; Belgium-Luxembourg 974.
Phosphatic	279	33	--	Republic of South Africa 18; France 15.
Potassic	249	3,701	(2)	Jordan 3,600.
Unspecified and mixed	29,765	24,863	--	France 8,278; Mauritius 8,078; Italy 7,000.
Gypsum and plaster	7,730	10,151	--	All from France.
Lime	1,784	1,467	--	Kenya 757; Mauritius 358; France 272.
Magnesium compounds, unspecified	154	35	--	All from Netherlands.
Mica: Crude including splittings and waste	13	21	--	All from France.
Phosphates, crude	--	768	--	All from Republic of South Africa.
Pigments, mineral: Iron oxides and hydroxides, processed	62	33	--	France 17; West Germany 16.
Precious and semiprecious stones other than diamond: Natural value, thousands	$29	$33	--	India $12; Hong Kong $9; France $8.
Salt and brine	2,224	3,495	--	West Germany 1,597; Madagascar 1,236.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	18	10	--	All from France.
Sulfate, manufactured	478	491	--	France 481; Italy 10.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	--	42	--	All from Italy.
Worked	399	484	--	France 409; Italy 68.
Gravel and crushed rock	2	49	--	All from France.
Quartz and quartzite	4	7	--	Do.
Sand other than metal-bearing	29	16	--	Do.
Sulfur:				
Elemental: Crude including native and byproduct	--	1	--	Do.
Sulfuric acid	129	99	--	France 78; West Germany 21.
Talc, steatite, soapstone, pyrophyllite	60	5	--	All from France.
Other:				
Crude	66	131	--	Do.
Slag and dross, not metal-bearing	1	--		
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	22	20	--	All from Republic of South Africa.
Carbon black	3	1	--	All from France.
Coal	2	1	--	Do.
Peat including briquets and litter	1	22	--	West Germany 19; France 3.
Petroleum refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	183	--		
Gasoline, motor do	807	965	--	Bahrain 924; United Arab Emirates 31.
Mineral jelly and wax do	(3)	--		
Kerosene and jet fuel do	380	391	--	Bahrain 359; Yemen (Aden) 32.
Distillate fuel oil do	516	629	--	Bahrain 612.
Lubricants do	23	30	(3)	France 15; Republic of South Africa 10.
Residual fuel oil do	65	115	--	United Arab Emirates 54; Tanzania 39.
Bitumen and other residues do	47	--		
Bituminous mixtures do	1	1	--	Mainly from France.

[1]Table prepared by Virginia A. Woodson.
[2]Unreported quantity valued at $3,000.
[3]Less than 1/2 unit.

RWANDA

Rwanda was the most densely populated country in Africa, with a population slightly over 6.3 million and land area slightly smaller than Belgium. It was heavily dependent on agriculture for subsistence and foreign exchange. Coffee and tea were the major foreign-exchange earners with coffee accounting for approximately 70% of all export revenues. Rwanda's sole mineral agency, Société Miniére du Rwanda (SOMIRWA), went into receivership in September 1985. The Government was making

strenuous efforts to reorganize the industry, and international agencies including the International Monetary Fund (IMF) were investigating possible solutions.

SEYCHELLES

The only mineral-related operations on the islands of Seychelles remained small sand and gravel pits for local construction, and collection and processing of guano for fertilizer.

SOMALIA

The only mineral produced in Somalia for commercial export was sepiolite (meerschaum). For local consumption, salt was produced from coastal evaporation pans and limestone for cement was quarried at Berbera. Roads were poor, and there was no railroad system.

Somalia's external debt at the end of 1987 was approximately $2 billion.[9] The Government was unable to pay even the interest on this debt during the year, and at the Paris Club meeting held in July, the country's debts were rescheduled. Somalia's trade deficit for 1987 was estimated at $400 million.

To boost both private and foreign participation in the Somalian economy, a new foreign investment law was enacted in July. The law was to allow both profits and salaries originating from a registered investment to be transferred abroad. Profits reinvested could be transferred abroad after 5 years. Up to 50% of the salaries, wages, or gratuities of foreign personnel could be transferred out of the country.

There was substantial interest in petroleum exploration Somalia in 1987 by several international oil companies. Amoco Somali Petroleum Co. signed an agreement for an 8.6-million-acre onshore concession covering three contiguous tracts spanning from north to southwest of the capital city of Mogadishu. The agreement was for a 3-year period, with three 1-year extensions possible. Aeromagnetic, gravity, and seismic field studies began in August.

Amoco also signed an agreement with Consolidated International Petroleum and Gulf Stream Resources for one-half-interest in a 4-million-acre concession on the northeast coast. At least one well was to be drilled in the concession during 1988. Chevron Oil Co. of the United States was preparing a drilling site at yearend in its northern concession near Zeila, on the Gulf of Aden coastline. Drilling was expected to begin in February 1988.

SUDAN

Sudan's economy continued to be in trouble in 1987. Standing at approximately $14 billion[10] at yearend, the country's external debt was 1.5 times its GDP. One-third of worldwide overdue payments to the IMF were Sudan's. The Government had defaulted on paying even the interest on IMF loans since 1985. In August, the Government reached a 1-year emergency agreement with the IMF, and in October the Minister of Finance announced the formal adoption of a reform program. The reforms included devaluing the Sudanese pound 40%, increasing local taxes and the prices of staples, changes in the Islamic banking practices, and a 4-year program to decrease Government regulation and enhance opportunities for private and foreign investment.

Mining activities in Sudan included small-scale chromite operations, salt from coastal evaporation pans, limestone for cement as well as other small amounts of industrial minerals for construction purposes, and gold. The gold production continued to expand during the year and was proving to be a profitable activity for mining firms and the Government alike.

The Gebeit gold mine in Sudan's Red Sea Hills was officially commissioned in November. Minex Developments operated the mine on behalf of its parent company, Greenwich Resources Ltd. of the United Kingdom, which owned 49% of the operation. The Government of Sudan owned the rest. Between the start of experimental mining at Geibeit in June 1983 and the end of 1986, more than 3,200 ounces of gold were produced. Much of the production came from leaching surface piles since the underground operations did not begin until the

latter part of 1987. Operations were being conducted from an existing 45° inclined shaft. The shaft was rehabilitated and deepened from 70 meters to 140 meters. Plans were to extend the shaft an additional 120 meters to facilitate mining.

The capacity of the mine's vat leaching operation was increased from 100 tons per day to 300 tons per day. The processing plant was essentially completed during the year, by GEC Mechanical Handling of the United Kingdom, and comprised crushing, grinding, gravity separation, flotation, leaching, and smelting components.

Production in 1988 was expected to average approximately 100 ounces per day, and that rate was expected to double by 1992. Reserve figures in 1987 for Gebeit were put at 400,000 tons with an average grade of 15.9 grams per ton.

Gebeit was not the only gold mine in operation in 1987. In northeast Sudan BRGM and Total Cie. Miniére poured their first gold on March 1, 1987, at their Hassai Mining operation. Development of Hassai began in early 1986 and continued throughout 1987. Commissioning of the mine was expected at yearend 1988. The gold reserve estimates for Hassai at yearend 1987 were 405,000 ounces. Exploration was to continue in 1988, with prospecting attention to be focused on the Ginyat, Kiniwaip, and Nijaim areas.

SWAZILAND

Mining in Swaziland accounted for approximately 3% of the country's GDP in 1987. Revenues from minerals were derived primarily from asbestos and coal mining, and from a small diamond mine that was in its third full year of operation. Although diamond production was not officially reported, sharp revenue increases indicated a significant increase in output from the Dvokolwayo Mine. Asbestos remained the largest source of mineral revenue, although coal mining was regarded as the mineral product with the greatest long-term potential.

Mineral export revenues increased to $19.6 million,[11] which represented an increase of 11% in local currency and 26% in U.S. dollar terms, allowing for a 10.6% depreciation of the emalengeni against the dollar in 1987. Asbestos revenues were $10.2 million, up 13% in dollar terms; diamond revenues were $1.8 million, up 27%, and coal revenues declined 17% to $3.2 million. Production of stone for commercial use decreased almost 20%, with a corresponding decrease in sales revenues to $0.8 million. The total work force in Swaziland's mineral industry was 2,380, a slight decrease from the previous year. One-half were involved in surface mining.

The Havelock asbestos mine experienced a difficult year, due mainly to declining reserves. Tonnage of ore milled declined 7% to about 729,500 tons; however, the use of surface stockpiles allowed the mine to increase its production of chrysotile fiber by almost 25%. Asbestos sales, mostly for export, increased 11% to about 25,400 tons. The Republic of South Africa remained the main export market in 1987, receiving 10,500 tons of fiber worth $21 million. Other major markets were Japan, France, and Thailand.

Throughout the year mining problems occurred in the underground asbestos workings due to greater dilution of the ore body and a significant drop in recovery of longer, better quality fiber ore. Heavy ground conditions and equipment breakdowns contributed to a significant increase in operating costs. As a result of financial losses in 1987, a plan was submitted to the Government in September to revise mining operations to make the mine economically viable in 1988. The plan agreed to at yearend would lower mine production to 600,000 tons of ore per year and decrease the work force by almost 25% (approximately 450 workers). A review of the industry by the American Embassy in Mbabane indicated that even with the development of new asbestos deposits to the west of the Havelock Mine, economically viable asbestos reserves may be exhausted within 5 years.

Production of coal decreased slightly from Swaziland's sole operation, the Mpaka Mine in the eastern Lowveld area. Sales rose 6% to 187,000 tons for the year. Export sales were up 3% to 157,000 tons. However, depressed international market prices resulted in a 17% drop in revenues in dollar terms, from a record $3.9 million in 1986. The main export market remained the Bamburi cement works in Kenya, which increased orders from 65,000 tons in 1986 to 109,000 tons in 1987. Exports of coal to the Republic of Korea for briquetting amounted to 47,800 tons, a substantial decrease from the 90,000 tons bought in 1986. All coal shipments were through the port of Mapu-

to, Mozambique.

Negotiations on the proposed construction of a 60,000-ton-per-year ferrochrome plant in Swaziland were at a stalemate over Swazi Chrome's request to the Republic of South Africa to supply additional electricity to run the plant. Several gold exploration agreements, including one with Rio Tinto Zinc Corp. were signed to examine the gold potential of the Pigg's Peak and Nhlangano regions.

Following an alleged scandal involving the Minerals Committee, the King of Swaziland appointed a new seven-member Minerals Committee along with a special minerals negotiating committee to oversee all agreements and conditions.

TANZANIA

Agriculture contributed 80% of the country's foreign-exchange earnings, 90% of its employment, and 40% of its GDP for 1987. As part of a 3-year recovery program under way, the U.S. Agency for International Development provided $46 million[12] toward rehabilitating the country's Tazara Railroad (Dar es Salaam, Zambia). New locomotives and spare parts were badly needed by the railroad, as well as a major overhaul of equipment and shops to maintain the rail line system. For the rehabilitation of Dar es Salaam's ocean port, a donation of copper handling equipment was made to the port authorities by the Swedish International Development Agency. The new equipment was expected to expedite Zambian copper exports, which were first rerouted through Dar es Salaam in December 1986. The copper handling equipment was valued at $2 million.

To reduce smuggling, the Government increased the allowable retention of foreign exchange earnings from gold and gem stone mining by artisans from 50% to 70% of the sale value to the government. Several thousand prospectors were estimated to be operating in the northern Shinyanga area, where they could illegally receive as much as 10 times the official rate for gold.

The exploration concession of the Geneva-based Dar Tadine Tanzania (DTT) expired in November, completing a 3-year project that accomplished little of the originally proposed $25 million program. Only gold buying and an unsuccessful heap-leaching operation of old tailing piles were attempted by DTT over the life of the project. A commission of inquiry was to be formed by the Government in 1988 to investigate the failed project. Parliament officials were critical of the program's results, particularly in light of the fact that DTT was given five attractive concessions covering 7,000 square kilometers near Lake Victoria for gold exploration. DTT suspended the Buhemba static leach operation of small gold-tailing piles in mid-1986 because of poor recoveries.

The Kiwira coal mine was being developed throughout the year and was expected to begin commercial operations in October 1988. The coal project was a Chinese aid program estimated to cost $7.23 million. The mine was to be operated by Kiwira Coal Mining Co., a subsidiary of Tanzania's State Mining Co. (STAMICO). Initial production for the mine was to be 150,000 tons per year, rising to 600,000 tons per year. The coal was to be used for both domestic and industrial purposes and eventually for a proposed 6 megawatt power station to be built at Keyela.

The Williamson Diamond Mines Ltd. continued to be plagued by a lack of equipment and spare parts. Production continued to decline and was estimated to be 150,000 carats in 1987, a record low for the 26-year-old operation. The operation was owned 50-50 by the Government and private owners. The operation had a record-high production in 1966 of 925,000 carats. In 1987, approximately 2.7 million tons of ore was mined and processed at Mwasdui, while the target for the year was 3.3 million tons. The recovered ore grade of 6.3 carats per 100 tons was almost 25% less than expected. Williamson's new Alamasi Mine contributed 25,000 tons of ore in 1987.

UGANDA

As in many recent years, the Ugandan economy struggled throughout 1987. Although civil security improved, the economy further declined. The rate of decline had leveled off by midyear and was expected to reverse itself in 1988. In June 1987, the

Government recalled the currency and issued new banknotes and coins. One new shilling was issued for 100 old shillings, and there was a 30% conversion tax. Part of the reason for issuing the new currency that the old Ugandan shilling was so devalued that it was practically worthless.

The rate of inflation rose during the year, but declined to 200% by yearend. In June, the Paris Club rescheduled $60 million[13] in debts due for settlement during the year and pledged $800 million towards rehabilitation and development for Uganda. The Ugandan external debt was $1.2 billion at yearend.

For the ninth consecutive year, the Kilembe copper mine remained on a care-and-maintenance basis. Negotiations with North Korea were under way at yearend for technical and financial assistance to rehabilitate the operation. Part of the proposed rehabilitation was the construction of a foundry at Kilembe large enough to produce equipment and spare parts for all of Uganda's mining industry. The same foundry would supply the cement plants at Hima with spare parts.

The project would also involve the construction of a copper smelter, cobalt recovery plant, and sulfuric acid plant complex. All were to be built at Kasese where an estimated 1.1 million tons of cobalt pyrite concentrates from the mine were stockpiled during the 1970's. The cost of the three plants was estimated at $25 million and the cost of rehabilitating the mine $20 million. The Ministry of Minerals and Water Development estimated that 2,400 tons of cobalt carbonate per year could be produced from the stockpile, while slightly over 100,000 tons of 98% sulfuric acid per year could be produced. The acid production was expected to be shipped to Tororo for use in the manufacture of phosphate fertilizers from local reserves of apatite and pyrochlore ore. The EEC also extended credit during the year for renovation of the Nkombe sawmill, which supplies hardwood as well as timber for underground support at the Kilembe Mine.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Burundi francs (FBu) to U.S. dollars at a rate of FBu125.00=US$1.00.

[3]Mining Annual Review. Min. Mag., Aug. 1987.

[4]Where necessary, values have been converted from Djibouti francs (DF) to U.S. dollars at the rate of DF180.00=US$1.00.

[5]Where necessary, values have been converted from Ethiopian birr (EB) to U.S. dollars at the rate of EB2.07=US$1.00.

[6]Where necessary, values have been converted from Kenyan shillings (K Sh) to U.S. dollars at the rate of K Sh16.30=US$1.00.

[7]Where necessary, values have been converted from Malawian kwacha (MK) to U.S. dollars at the rate of MK2.20.00=US$1.00.

[8]Where necessary, values have been converted from Mozambican meticais (M) to U.S. dollars at the rate of M300.00=US$1.00.

[9]Where necessary, values have been converted from Somali shillings (So.Sh) to U.S. dollars at the rate of So.Sh100.00=US$1.00.

[10]Where necessary, values have been converted from Sudanese pounds (Sd) to U.S. dollars at the rate of Sd 4.50=US$1.00.

[11]Where necessary, values have been converted from Swazi emalangeni (E) to U.S. dollars at the rate of E2.03=US$1.00 for 1987 and E2.27=US$1.00 for 1986. (NOTE: This is a correction of conversion rate inadvertently used in 1986 Minerals Yearbook.)

[12]Where necessary, values have been converted from Tanzanian shillings (TSh) to U.S. dollars at the rate of TSh65.00=$1.00.

[13]Where necessary, values have been converted from Ugandan shillings (USh) to U.S. dollars at the rate of USh60.00=US$1.00.

The Mineral Industry of Other West African Countries

By David J. Ellis and Hendrik G. van Oss[1]

CONTENTS

BENIN

The mineral industry of Benin continued to be confined to the production of cement, crude oil, salt, and sand and gravel. Only crude oil and cement were exported, with the value of crude oil exports and cement exports constituting about 20% and 2% of export revenue, respectively. The value of crude oil exports was less than the cost of imports of refined petroleum products.

Production of crude oil was unchanged from 1986, averaging 5,500 barrels per day (bbl/d). The Government managed the facilities at the Semé Oilfield while actively seeking a new manager to replace Pan Ocean Oil Co. of Switzerland, whose contract was canceled in 1986. Recoverable reserves of crude oil were estimated to be between 18 and 30 million barrels.

Benin's three operating cement plants had a combined capacity of 1 million tons per year, but were producing well below that level. The most recently constructed of the three, the Société des Ciments d'Onigbolo, was built as a joint venture with Nigeria, and most exports of cement were purchased by Nigeria.

Table 1.—Other countries of West Africa: Production of mineral commodities[1]

Country[2] and commodity[3]	1983	1984	1985	1986[p]	1987[e]
BENIN					
Cement, hydraulic[4] metric tons	300,000	300,000	300,000	300,000	300,000
Petroleum, crude thousand 42-gallon barrels	1,000	2,500	3,000	2,000	2,000
Salt, marine[e] metric tons	100	100	100	100	100
BURKINA FASO (formerly Upper Volta)					
Gold[e] troy ounces	--	500	50,000	60,000	80,000
Phosphate rock[e] thousand tons	3	3	3	3	3
Stone: Marble[e] cubic meters	--	50	100	100	100
Pumice and related volcanic materials[e] metric tons	10,000	10,000	10,000	10,000	10,000
Salt do	6,500	6,500	6,500	6,500	6,500
IVORY COAST					
Cement[4] thousand metric tons	636	536	679	776	[5]653
Diamond[e 6]	NA	25,000	20,000	13,000	21,000
Gold troy ounces	--	--	--	--	210
Petroleum:[7]					
Crude thousand 42-gallon barrels	8,760	9,960	8,060	6,600	6,200
Refinery products:					
Gasoline do					
Kerosene and jet fuel do					
Distillate fuel oil do	NA	NA	NA	NA	NA
Residual fuel oil do					
Liquefied petroleum gas do					
Refinery fuel and losses do					
Total do	NA	NA	NA	NA	NA
MALI					
Cement, hydraulic metric tons	[e]20,000	25,365	19,005	20,000	22,000
Gold, mine output, Au content[e 8] troy ounces	13,000	[5]16,075	[5]16,075	16,100	22,500
Phosphate rock[e] metric tons	10,000	3,250	[5]3,000	3,000	30,000
Salt[e] do	4,500	4,500	4,500	4,500	4,500
Stone: Marble do	NA	758	769	750	200
NIGER					
Cement, hydraulic do	38,000	38,000	38,000	38,000	40,000
Coal do	118,609	123,644	150,635	150,000	164,000
Gypsum[e] do	3,000	3,000	3,000	30,000	NA
Molybdenum concentrate, Mo content[e] do	40	33	20	20	15
Phosphate rock do	1,000	1,000	1,000	1,000	--
Salt[e] do	3,000	3,000	3,000	3,000	3,000
Tin, mine output, Sn content do	40	76	[e]100	80	110
Uranium concentrate, U_3O_8 content do	4,041	3,276	3,236	3,200	3,000
SENEGAL					
Cement, hydraulic do	394,916	384,821	406,890	360,000	372,000
Clays: Fuller's earth (attapulgite) do	100,375	115,498	95,957	81,857	11,048
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	484	546	[e]540	550	800
Jet fuel and kerosene do	442	401	[e]400	400	576
Distillate fuel oil do	538	675	[e]680	650	1,270
Residual fuel oil do	566	786	[e]790	750	1,395
Other do	20	23	[e]20	20	43
Refinery fuel and losses do	137	233	[e]230	230	213
Total do	2,187	2,664	[e]2,660	2,600	4,297
Phosphate rock and related products:					
Crude:					
Aluminum phosphate thousand metric tons	1,187	279	355	131	191
Calcium phosphate do	1,254	1,932	1,814	1,850	1,874
Manufactured:					
Aluminum phosphate, dehydrated do	144	142	200	60	89
Other[9] do	3	7	8	5	4
Salt[e] metric tons	170,000	165,000	[5]160,000	[5]145,000	100,000

See footnotes at end of table.

Table 1.—Other countries of West Africa: Production of mineral commodities[1] —Continued

Country[2] and commodity[3]	1983	1984	1985	1986[p]	1987[e]
TOGO					
Cement products:					
Clinker ---------- thousand metric tons	693	154	--	--	--
Cement[10] ---------- do	232	243	284	348	370
Iron and steel:[e]					
Crude ---------- do	2	--	--	--	--
Semimanufactures ---------- do	2	--	[5]7	[5]9	12,094
Phosphate rock, beneficiated product do	2,010	2,400	2,450	[5]2,208	2,544
Stone: Marble, dimension ---- square meters	5,177	5,317	[11]5,671	5,000	10,800

[e]Estimated. [p]Preliminary. NA Not available.
[1]Includes data available through Sept. 25, 1987.
[2]In addition to the countries listed, The Gambia and Guinea-Bissau, which are covered in the text of this chapter, presumably produced a variety of crude construction materials (clays, sand and gravel, and stone) and may produce 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, a variety of crude construction materials (clays, sand and gravel, and stone) presumably is produced, but output is not reported quantitatively, and available information is inadequate to make reliable estimates of output levels.
[4]Output based entirely on imported clinker.
[5]Reported figure.
[6]Does not include smuggled diamonds.
[7]Data are for year ending July 30 of that stated.
[8]Production for Soviet-Malian Mine.
[9]Products marketed under the trade names "Balifos" and "Phospal."
[10]In 1984, production of domesitic clinker ended, and in 1986, all cement was produced from clinker imported from Western Europe.
[11]The Société Togolaise de Marbrerie et de Matériaux produced 1,205 metric tons of marble block in 1985.

BURKINA FASO

The mining industry in Burkina Faso continued to focus principally on gold, despite notable deposits of several other minerals. Unavailability of financing and the lack of an adequate countrywide transportation infrastructure precluded further development. The only other minerals produced were small quantities of marble and phosphate rock.

Although exports of gold provided a boost to export revenues in 1986 and 1987, probably making up about 20% of the value of total exports in both years, the economy remained stagnant as a result of droughts and a slowdown in private investment.

COMMODITY REVIEW

Metals.—*Gold.*—The Société de Recherches et d'Exploitation Minières du Burkina (SOREMIB) entered its third full year of production at the Poura gold mine southwest of the capital, Ouagadougou. The Poura deposit had been exploited between 1959 and 1966, before closing because of depleted reserves. SOREMIB, a joint venture between the Government, 60%; the Islamic Development Bank, 20%; and Cie. Française des Mines S.A. (Coframines), a subsidiary of Bureau de Recherches Géologiques et Minières (BRGM) of France reopened the mine in late 1984 on the basis of the discovery of additional reserves. Although official production figures have not been released, output from Poura accounted for almost all of Burkina Faso's gold production.

Investigation of several other gold prospects continued, including studies of deposits at Sebba and Dori-Yalogo. However, the only gold production, other than from Poura, was by small-scale, artisanal workers. All official gold sales were made through the Government, which controlled exports of gold.

Silver and Zinc.—Feasibility studies were continued on the zinc-silver deposit at Perkoa, about 150 kilometers west of Ouagadougou, and within 40 kilometers of the main railway linking Burkina Faso with the Atlantic Ocean at Abidjan, in the Ivory Coast. The deposit was estimated to contain 10 million tons of ore with up to 20% zinc and with silver grading as high as 60 grams (1.93 troy ounces) per ton.

Industrial Minerals.—The Cie. Voltaique d'Exploitation Minière, formed in 1982, pro-

duced small quantities of marble from its quarry at Tiara. Reserves at the quarry were estimated to be 60,000 cubic meters.

CAPE VERDE ISLANDS

There was no change in the limited mineral industry of Cape Verde. Production of mineral commodities was confined to small quantities of pozzolana, pumice, and salt, of which salt was the only export commodity. Portugal remained Cape Verde's principal trading partner, accounting for more than 50% of both imports and exports.

THE GAMBIA

Offshore seismic studies continued in an effort to locate potential sites for crude oil exploration. A consortium of U.S. oil companies headed by Aracca Petroleum carried out seismic studies over a 3,300-square-kilometer area. An aerial photography program, sponsored by the U.S. Agency for International Development, was completed, and the results were planned to be used in the preparation of geologic maps.

GUINEA-BISSAU

The Government of Guinea-Bissau embarked on a 3-year program of financial reorganization and economic recovery in 1986, with the deregulation of trade, devaluation of the national currency, and a reduction of the debt-service burden as the principal objectives. In May 1987, the Guinean peso was devalued to match parallel market levels, and negotiations on debt rescheduling were begun with creditor nations and international banking agencies. A $40 million[2] structural adjustment loan was granted by the International Bank for Reconstruction and Development, and other economic concessions and debt reschedulings were negotiated with the International Monetary Fund and the Paris Club.

Guinea-Bissau also began negotiations with the West African Monetary Union (UMOA), as the first stage in becoming part of the franc zone, whereby it would begin using Communauté Financière Africaine francs (CFAF) as official currency. The advantage to such an affiliation would be that CFAF are freely convertible with French francs and would help stabilize the banking system.

Production of mineral commodities was limited to undocumented quantities of building materials destined for local markets.

IVORY COAST

The mineral industry remained a minor aspect of the economy of the Ivory Coast. Petroleum production declined for the third consecutive year and available information indicated that Ivorian oil was scattered in small deposits in deep water. Diamond production showed no significant increase and continued to suffer through illicit export. Production of cement depended on imports of clinker and decreased in comparison with that of 1986. The only industry with any apparent promise of future foreign-exchange earnings was gold mining, in which there has been revived interest since 1985.

After 2 years of economic upturn during 1985 and 1986, the economy of the Ivory Coast suffered a major setback in late 1986, when commodity prices slumped for coffee and cocoa, major revenue earners for the Ivory Coast. The slump followed closely in the wake of debt rescheduling and the approval of new loans from international banking agencies, which were predicated on the basis of earlier commodity prices. Decreased revenues affected the ability of the Ivory Coast to make scheduled debt payments in 1987. The Government suspended debt payments in May, pending new agreements with creditors based on the modified circumstances. Foreign debt was estimated to be slightly less than $8 billion.[3]

After economic growth of 5.3% in 1986, the economy showed little real growth in 1987, as a result of cutbacks in Government spending and slowdowns in the development of new projects and investments. The balance of trade, while remaining positive, decreased substantially, with exports valued at about $3.4 billion, and imports estimated to be $2.7 billion. France continued to be the Ivory Coast's main trading partner, supplying almost one-third of Ivorian

imports and receiving about 17% of Ivorian exports. Other major trading partners, in order of decreasing importance, were: the United States, the Federal Republic of Germany, Nigeria, and Japan.

COMMODITY REVIEW

Metals.—*Copper and Nickel.*—The Government mining company, Société pour le Développement Minière de la Côte d'Ivoire (SODEMI), continued exploration of a copper-nickel deposit at Sampleu-Gangbapleu in the region of Biankouma. Seventeen boreholes totaling 1,924 meters were drilled to outline the mineralization. Additional work was required to estimate the extent of reserves.

Gold.—Official production of gold was reported to be slightly over 200 troy ounces, and exports were reported to be more than 8,000 ounces. This production probably came from artisanal miners, because none of the three operating joint ventures was in full production in 1987.

SODEMI was involved in two joint ventures with foreign mining firms. Société des Mines d'Ity, a joint venture between SODEMI, 60%, and Coframines, 40%, was formed in 1984 to exploit the Ity gold deposit near Issia, in the Toulepleu volcanic-sedimentary belt that covers southwestern Ivory Coast and overlaps into eastern Liberia. In 1987, the partners announced that the Ity project will be developed by heap-leaching technology in two phases. The $9.4 million first phase will treat the surface laterite ore at the rate of 55,000 tons per year in the first year and 115,000 tons per year for the following 6 years. The $18.5 million second phase will treat the underlying auriferous clay zone at the rate of 170,000 tons per year for 7 years. The grade of reserves at Ity was estimated at 10 grams (0.32 ounce) per ton of ore.

SODEMI was also a joint-venture partner in the Ivory Coast Syndicate (ICS) with Eden Roc Mineral Corp. of Canada. ICS began investigations in the Aboisso region, along the southeastern border with Ghana, in 1981. Several areas of mineralization have been discovered in the Afema shear zone, which follows the contact between volcanic formations and their associated sedimentary rocks. The most promising of these mineralized zones was the Asupiri 1 Zone. Three years (1985-87) of drilling the deposit to a depth of 346 meters had outlined ore reserves of 2.34 million tons averaging 6.2 grams (0.20 ounce) of gold per ton. By yearend, ICS had requested from the Government a permit to develop the project.

La Cie. Minière de la Côte d'Ivoire (COMICI) reported production of 2,572 grams (80 ounces) of gold from a small placer deposit at Carichy in the region of Tabou. The deposit was worked by artisanal methods between July 1986 and November 1987.[4]

Industrial Minerals.—Exploration of diamonds by SODEMI, using a portable washing plant, located a promising diamondiferous zone at Séguéla in the Bobi region. A pilot treatment of 908 cubic meters of ore yielded 247 gem-quality stones with a total weight of 255 carats. An estimated 90% recovery was achieved.

Mineral Fuels.—Production of crude oil decreased about 6% in 1987, with production restricted to the Belier and Espoir offshore fields. Although three companies still held exploration permits, little exploration work had been done in recent years, owing to the small size of the oilfields and the necessity for deepwater exploration drilling.

The Ivory Coast continued to refine its own crude oil, as well as to refine oil on contract for neighboring countries. Two oil refineries were in operation in the vicinity of Abidjan. The larger, owned by the Société Ivoirienne de Raffinage, had capacity for 64,000 bbl/d. Société Multinationale de Bitumes-Abidjan had a refining capacity of just over 10,000 bbl/d, and produced mainly asphalt for domestic use and for export to other West African countries.

MALI

Exploration for and development of gold continued to be the dominant aspect of Mali's mineral industry. Although significant deposits of several other minerals, notably bauxite, iron ore, phosphate rock, and uranium, had been identified, a lack of infrastructure, low world commodity prices, and the arid climate, precluded development of anything except a minor amount of phosphate for domestic use.

Mali's economy was based mainly on exports of agricultural products and showed real growth of approximately 3.5% in 1987. Gold was the only mineral product exported, with reported value of just over $7 million;[5] less than 5% of export revenue. Mali's main trading partners were France, Belgium, the Federal Republic of Germany,

and the Ivory Coast. Mali had experienced a trade imbalance over the last several years and showed a trade deficit exceeding $200 million in 1987. Mali's foreign debt reached $1.7 billion, mostly in the form of bilateral loans, and debt service was equivalent to roughly one-third of export revenue.

The Kalana gold mine was the only official producer of gold, although some gold was mined by artisanal workers. Production at Kalana had averaged about 20,000 ounces per year. It was expected to rise to double that rate by 1990, perhaps topping 50,000 ounces per year at peak capacity. When the mine was opened in 1984, proven reserves were announced of almost 1 million ounces, but further investigations had revealed increased reserves in and around the existing ore bodies.

Société Minière de Loulo, a joint venture between the Government, 51%, and BRGM, 49%, was formed to attempt the mining of the Loulo gold deposit west of Bamako, near the border with Senegal. Reserves were estimated at approximately 160,000 ounces of gold, with production lasting 9 years, beginning in 1989. BRGM and the Government of Mali have been working together since 1978 to discover commercially viable mineral deposits, especially gold and diamond.

In midyear, the Government granted BHP-Utah International Inc., an Australian company, exploration rights to a 1,500-square-kilometer concession in the Bagoe region of southern Mali. BHP-Utah agreed to spend $1.5 million on preliminary exploration, with provision for expansion if results were promising.

Toward yearend, there were reports of the discovery of a significant geochemical anomoly in the Massigui quadrangle near Morila in southwestern Mali. The discovery was made as part of a joint exploration program between the Direction Nationale de la Géologie et des Mines of Mali, and the Bureau de Géologie pour la Cooperation Internationale of Belgium. Unlike most other gold discoveries in Mali, the anomoly was found not at the site of old workings, but over extensively altered Birrimian volcanic-sedimentary rocks. The formation lies at the uppermost extension of the curving Birrimian mineralized belt in which much of Ghana's gold has been discovered.[6]

NIGER

Uranium concentrate continued to be Niger's principal export commodity, despite steadily diminishing production over the last 6 years. The only other mineral commodities exported were molybdenum concentrate and tin in the form of cassiterite ore.

Sales of uranium provided more than 80% of total export revenue, and were valued at more than $300 million[7] in 1987. Exports of uranium oxide were reported to be approximately 6,600 tons, more than double the production for the previous year. France was the main market for Niger's uranium, purchasing 5,580 tons of uranium oxide at above-market prices as agreed in a long-term contract. Other purchasers of uranium were the Federal Republic of Germany, Italy, Japan, and Spain. Niger has long-term sales contracts for its uranium, running through 1990, with the member countries in the two uranium mining consortiums.

Production of tin was scheduled to increase in 1987 and to continue increasing through 1991, by which time mine capacity would be almost 200 tons per year, SnO_2 content. Société Minière du Niger had been mining tin at several minor sites in and around the Air Massif, and most of the production was shipped to the Netherlands. Exports were reported to be about 140 tons, valued at just under $1 million. Niger had been stockpiling cassiterite ore while awaiting improved world tin prices.

Production of molybdenum, as a byproduct of uranium mining, had been dwindling since 1980, the first full year of production. Capacity was still listed at 400 tons per year of concentrate containing 35% Mo; metallurgical problems at the treatment plant were blamed for the low metal content of the output.

SENEGAL

As in years past, phosphate mining was the only significant factor in the Senegalese minerals industry. As a result of a worldwide drop in demand for fertilizers, export earnings from phosphates dropped, despite a minor increase in production. Export earnings from phosphate rock, clinker, and attapulgite mining were almost $66 mil-

lion,[8] and export earnings from manufactured phosphate fertilizers and related chemicals were just over $66 million. These sources accounted for about 16% of Senegal's export revenues.

E. I. du Pont de Nemours & Co. Inc. conducted preliminary exploration for titanium (ilmenite) sands and was engaged in negotiations with the Government of Senegal for related long-term exploration and mining rights. Senegal's titanium sand reserve potential was considered to be large.

COMMODITY REVIEW

Industrial Minerals.—Phosphate was produced by two mining concessions: Cie. Sénégalaise des Phosphates de Taïba (CSPT) and Société Sénégalaise des Phosphates de Theis (SSPT). Phosphate demand decreased worldwide, and the resulting drop in prices led to a small drop in Senegal's export revenues despite the fact that the country managed to increase its phosphate exports slightly. As in previous years, the phosphate industry in Senegal was hurt by the very high cost of electricity, which represented more than 25% of the phosphate production costs, and by relatively high costs of transport to its major customers in the European Economic Community (EEC). These costs were far lower for its major phosphate-exporting rivals Algeria and Morocco. The major destinations of Senegalese phosphate rock remained the EEC, Japan, India, Yugoslavia, the Philippines, Uruguay, and the Republic of Korea. Senegalese phosphate rock has a high cadmium content, and phosphate exports to the EEC were threatened by proposed legislation governing the cadmium content of fertilizers. The Government of Senegal appealed to the EEC for further studies on the environmental effects of cadmium before imposing a ban on Senegalese phosphate. The world market for manufactured phosphate products also declined in 1987. As a consequence, local sales of phosphate rock to Industries Chimiques du Senegal dropped by about 7% to about 529,000 tons.

The market for aluminum phosphate remained relatively strong, and its producer, SSPT, increased production in 1987 by almost 46% to about 191,000 tons. Clinker production by SSPT rose by about 47% to almost 89,000 tons. Similarly, attapulgite production by SSPT rose by 35% to about 111,000 tons.

Mineral Fuels.—Four companies were actively engaged in oil exploration in both onshore and offshore concessions. While several favorable geologic structures were identified and explored, no oil discoveries were announced.

TOGO

In 1987, the Togolese mineral industry accounted for about 12% of Togo's annual gross domestic product. The mineral sector was dominated by phosphate production, which represented about 27% of the country's export earnings. In 1987, all mineral plants in operation in Togo increased their production.

COMMODITY REVIEW

Industrial Minerals.—*Cement.*—The 1987 cement production of about 370,000 tons represented a 6% increase. As had been the case since the closure of the local clinker plant in 1984, cement production relied entirely on imported clinker. Clinker imports amounted to about 341,000 tons, of which about 313,000 tons was used in cement production. Clinker imports were from Spain, Greece, the German Democratic Republic, and Belgium. Ciments du Togo (CIMTOGO) sold about 374,000 tons of cement in 1987, of which about 111,000 tons was exported to Benin, Burkina Faso, Mali, Ghana, and Gabon. These exports represented a 13% increase over 1986 levels, while local sales increased by 4%. Total cement sales in 1987 amounted to about $62.8 million.[9]

Marble.—The Société Togolaise de Marbrerie et de Matériaux (SOTOMA) was restructured in late 1986, at which time the Togolese Government's ownership was reduced from 67% to 39%, with the remainder of the company being owned by CIMTOGO (24%) and A/S NORCEM of Norway (37%). The restructured company, Nouvelle SOTOMA, produced about 10,800 square meters plus 808 tons of marble in 1987. This production was more than double the production in 1986, but still represented a level well below the company's capacity of 250 square meters per day. The company exported about 3,400 square meters plus 125 tons of marble to Benin, Ghana, and the Ivory Coast.

Phosphates.—Phosphate remained Togo's most important mineral resource. In 1987, the Government-owned phosphate mining and marketing company, Office Togolais des Phosphates (OTP), produced about 2.5 mil-

lion tons of phosphate, which represented about 69% of the company's production capacity. OTP exported about 2.4 million tons; a 9% increase over 1986 exports. The International Monetary Fund estimates that Togo's 1987 phosphate exports were worth about $81.7 million. Because of European concerns over the high cadmium content of Togolese phosphate, it was expected that future foreign demand for Togolese phosphate would weaken. Togo continued to experience difficulty in attracting financing for its $500 million Kpeme phosphate project, which would involve the construction of a phosphoric acid plant and a triple superphosphate plant, and the development of a new phosphate mine at Dagbati.

Metals.—In 1984, as part of a general privatization policy, a 10-year lease was signed between U.S. private investor John Moore and the Government of Togo. The investor took control of the closed Government-owned steel mill, and converted it to produce finished products from imported semifinished products and scrap, including railroad steel. The mill resumed production at the end of 1984 under the name Société Togolaise de Sidérurgie (STS). It produced high-quality rebar for both the local market and for export. In 1987, STS produced about 12,000 tons of rebar, valued at about $6.95 million, of which about 4,000 tons was exported. The 1987 production was a 36% increase over that of 1986.

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[1]Physical scientists, Division of International Minerals.

[2]Where necessary, values for Guinea-Bissau have been converted from Guinean Pesos at the rate of 561 pesos=US$1.00.

[3]Where necessary, values for Ivory Coast have been converted from Communauté Financière Africaine francs (CFAF) to U.S. dollars at the rate of CFAF302=US$1.00. The official CFAF exchange rate was maintained and freely convertible at 50 CFAF per French franc.

[4]Mining Magazine (London). V. 158, No. 5, May 1988, pp. 392-396.

[5]Where necessary, values for Mali have been converted from CFAF to U.S. dollars at the rate of CFAF302=US$1.00.

[6]Mining Journal (London). V. 309, No. 7947, Dec. 11, 1987, p. 477.

[7]Where necessary, values for Niger have been converted from CFAF to U.S. dollars at the rate of CFAF302=US$1.00.

[8]Where necessary, values for Senegal have been converted from CFAF to U.S. dollars at the rate of CFAF302=US$1.00.

[9]Where necessary, values for Togo have been converted from CFAF to U.S. dollars at the rate of CFAF302=US$1.00.

The Mineral Industry of the Islands of the Caribbean

By Ivette E. Torres and Harold R. Newman

CONTENTS

ARUBA[1]

Aruba, formerly a part of the Netherlands Antilles, separated on January 1, 1986, and became an autonomous part of the Netherlands. Full independence of the island from the Netherlands is scheduled for 1996. In this chapter, however, Aruba's statistics are included with those of the Netherlands Antilles.

Tourism continued to be the main industry of the island, which continued to depend heavily on imports, mostly from the United States. During the year, the Government was preparing legislation to regulate the exploration of oil deposits in the relatively shallow sea around Aruba.

Monte Carlo Gold Mines Ltd., a Canadian company, obtained the exclusive mining concession to all of Aruba in January 1987. After some promising discoveries, the company developed plans to carry out a $2.5 million[2] gold exploration program that would cover the entire island. The first step of the exploration program included an airborne electromagnetic and a magnetic survey of the island. After this was accomplished, Monte Carlo contracted with Terraquest Ltd. of Canada to do geophysical studies of selected areas that would be geologically sampled and mapped in detail. Preliminary exploration covered four sampling areas, each of which resulted in assays of over 1 troy ounce of gold per ton. Aruba has many known gold-bearing quartz veins as well as alluvial deposits. Aruba ceased all gold operations in 1916. In 1986, Canarub Gold Development N.V. conducted some mill tailings studies but found the gold recovery project uneconomical.

The Government of Aruba and the Caribbean Development & Commerce Co. agreed to reopen the former Exxon Corp. Lago refinery in 1987. The 400,000-barrel-per-day refinery was closed in March 1985. The agreement included a 10-year tax exemption. Instead of taxes, the company was to pay royalties. Investments necessary for refurbishing the refinery were estimated at $50 to $75 million. Reportedly, a Norwegian company was to provide the financing.

Table 1.—Islands of the Caribbean: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Country[2] and commodity	1983	1984	1985	1986[p]	1987[e]
BAHAMAS[3]					
Cement, hydraulic	25,683	--	--	91	--
Petroleum refinery products[e] thousand 42-gallon barrels	62,780	44,000	6,000	--	--
Salt thousand tons	862	[e]870	[e]850	899	[4]736
Stone: Aragonite do.	2,337	[e]2,200	[e]2,000	427	[4]1,524
Sulfur, byproduct of petroleum[e] do.	5	3	1	--	--
BARBADOS[3]					
Cement, hydraulic do.	--	[e]150	[e]215	199	[4]205
Gas, natural:[e]					
Gross million cubic feet	752	893	900	900	800
Marketed do.	360	370	370	370	360
Petroleum:					
Crude thousand 42-gallon barrels	380	635	679	559	510
Refinery products[e] do.	1,480	1,500	1,500	1,500	1,400
CUBA[3 5]					
Cement, hydraulic thousand tons	3,231	3,347	3,182	3,305	3,500
Chromite do.	34	38	38	108	110
Cobalt[6]	1,621	1,397	1,490	1,578	1,600
Copper, mine output, Cu content	2,667	2,701	3,076	[e]3,300	3,000
Gas, natural:					
Gross[e] million cubic feet	2,300	2,300	2,400	2,400	2,300
Marketed do.	293	120	244	[e]260	240
Gypsum[e] thousand tons	130	130	130	130	130
Iron and steel: Steel, crude do.	352	325	401	416	420
Lime do.	153	151	170	[e]180	160
Nickel:					
Mine output, Ni-Co content of oxide and sulfide	39,257	33,227	33,577	35,101	35,800
Metallurgical products, Ni content:[6]					
Granular oxide and powder	9,342	8,447	8,853	8,382	9,100
Oxide sinter	11,542	8,894	7,054	8,278	7,400
Sulfide	16,752	14,489	16,180	16,863	17,700
Total	37,636	31,830	32,087	33,523	34,200
Nitrogen: N content of anhydrous ammonia thousand tons	86	[r]171	189	[e]160	150
Petroleum:					
Crude[7] thousand 42-gallon barrels	4,937	5,125	5,771	[r e]6,000	6,600
Refinery products do.	48,180	48,340	46,020	[e]46,500	46,500
Pyrite, gross weight thousand tons	13	--	--	--	--
Salt do.	180	185	221	[e]230	230
Sulfur:[e]					
S content of pyrite do.	5	--	--	--	--
Byproduct of petroleum do.	8	8	8	8	6
Total do.	13	8	8	8	6
DOMINICAN REPUBLIC[3]					
Aluminum: Bauxite, dry equivalent, gross weight do.	--	--	--	--	[4]211
Cement, hydraulic do.	1,104	1,143	1,007	1,066	1,100
Coal, subbituminous	--	--	[e]600	[e]600	600
Copper, mine output thousand tons	[e]3	--	--	--	--
Gold thousand troy ounces	354	338	328	284	[4]246
Gypsum:[e]					
For cement manufacture thousand tons	180	180	280	102	42
Other do.	30	30	30	30	17
Iron and steel: Ferroalloys, ferronickel[8]	52,278	63,966	68,824	58,640	64,000
Lime[e]	40,000	40,000	34,000	34,000	36,000
Mercury 76-pound flasks	40	40	20	13	2
Nickel:[8]					
Mine output, Ni content	19,552	23,923	25,394	21,878	[4]32,521
Metal, smelter, Ni content of ferronickel shipments	21,200	24,220	25,809	21,989	[4]29,051
Petroleum refinery products thousand 42-gallon barrels	10,910	[e]11,000	12,647	[e]13,000	13,000
Salt[e]	60,000	60,000	[4]47,159	54,000	55,000
Silver thousand troy ounces	1,329	1,207	1,581	1,356	[4]1,148
GUADELOUPE[3]					
Abrasives, natural: Pumice[e] thousand tons	240	250	215	[r]221	220
Cement do.	[e]160	170	173	181	190
HAITI[3]					
Cement, hydraulic do.	[r]230	220	220	180	200

See footnotes at end of table.

Table 1.—Islands of the Caribbean: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Country[2] and commodity	1983	1984	1985	1986[p]	1987[e]
JAMAICA[3]					
Aluminum:					
Bauxite, dry equivalent, gross weight thousand tons	7,683	8,937	5,975	6,964	[4]7,833
Alumina do	1,851	1,749	1,513	1,575	[4]1,626
Cement, hydraulic do	277	261	240	241	[4]302
Gypsum do	108	180	179	117	[4]176
Lead, refined (secondary)[e]	1,000	1,000	1,000	1,000	1,000
Lime thousand tons	121	115	86	[e]92	90
Petroleum refinery products thousand 42-gallon barrels	8,366	8,243	9,008	9,309	9,200
Salt	--	--	[e]200	[e]200	200
Silica sand thousand tons	15	14	16	12	19
Stone:					
Limestone	--	[9]83,000	5,304	5,331	[4]5,650
Marble	320	370	50	200	10
Marl[e] thousand tons	9,069	8,640	6,210	[r]7,020	6,990
Sand and gravel[e] do	9,135	8,625	13,750	9,219	[4]1,770
MARTINIQUE[3]					
Cement, hydraulic[e] do	207	190	[e]200	[e]200	200
Petroleum refinery products thousand 42-gallon barrels	4,300	4,300	4,300	4,938	4,800
Pumice, converted from cubic meters[e] thousand tons	146	136	[e]150	[e]140	130
NETHERLANDS ANTILLES[3]					
Petroleum refinery products[e] thousand 42-gallon barrels	150,700	139,000	20,000	[4]58,400	83,600
Phosphate rock thousand tons	3	19	[e]20	[e]20	16
Salt[e] do	283	356	350	350	350
Sulfur, byproduct of petroleum do	87	63	[e]25	[e]40	60
ST. VINCENT[3]					
Salt[e] do	50	50	50	50	50
TRINIDAD AND TOBAGO[3]					
Asphalt, natural do	37	34	33	27	26
Cement, hydraulic do	[r]390	405	328	327	[4]327
Gas, natural:					
Gross million cubic feet	225,999	268,369	318,954	226,953	212,000
Marketed do	109,627	119,695	124,197	[e]132,300	123,000
Iron and steel:					
Iron, sponge thousand tons	302	239	205	208	[4]483
Steel, crude do	210	199	174	326	370
Semimanufactures (wire rod) do	164	135	103	217	[4]291
Lead, refined (secondary)[e]	2,000	2,000	2,000	2,000	1,800
Natural gas liquids[e] thousand 42-gallon barrels	40	40	40	40	40
Nitrogen: N content of ammonia thousand tons	[r]1,208	[r]1,306	1,367	1,393	1,400
Petroleum:					
Crude thousand 42-gallon barrels	58,344	62,042	64,259	61,435	[4]56,621
Refinery products do	27,178	31,077	29,678	[e]30,860	28,950
Stone: Limestone thousand tons	173	232	663	580	600
Sulfur, byproduct of petroleum[10] do	10	[e]7	165	[e]5	5

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

[1]Table includes data available through June 30, 1988.

[2]In addition to the countries listed, Antigua, Bermuda, Dominica, Grenada, Montserrat, and St. Lucia presumably produced crude construction materials (clays, sand and gravel, and stone), but output is not always reported, and information is inadequate to make reliable estimates of output levels.

[3]In addition to the commodities listed, crude construction materials (lime, salt, sand and gravel, stone, etc.) may also be produced, but data on such production are not always available and information is sometimes inadequate to make reliable estimates of output levels.

[4]Reported figure.

[5]In addition to the commodities listed, iron ore and manganese ore presumably were produced during the period covered by this table, but available information is inadequate to make reliable estimates of output levels.

[6]Anuario Estadistico de Cuba provides figures on nickel-cobalt content of granular and powder oxide, oxide sinter, and sulfide production. Using an average cobalt content in these individual products of 0.9% in total granular and powder oxide, 1.1% in total oxide sinter, and 4.5% in total sulfide, the cobalt content of reported Ni-Co production was determined as being 1.16% of granular and powder oxide, 1.21% of oxide sinter, and 7.56% of sulfide. The remainder of reported figures would represent the nickel content.

[7]Cuba reports crude oil production in metric tons. A conversion to barrels was made using a factor of 6.652. Some published production figures indicate a need to use a conversion factor of 7.3 to balance the units of measurement. However, pending more accurate information, the original factor will continue to be used in this publication.

[8]The Dominican Republic reports gross weight of ferronickel production. When official data are not available, figures for nickel content of mine production are determined from an average of 37.4% Ni contained in ferronickel production. Nickel content of ferronickel shipments is obtained from Falconbridge Dominicana C. por A. annual reports.

[9]Exports.

[10]Limited quantities of sulfur as a byproduct of natural gas may also be produced.

BAHAMAS[3]

The Bahamian economy continued to expand in 1987. Gross domestic product (GDP) increased by 8% relative to 1986. Tourism and banking were the mainstays of the economy. Construction was slowing down. Declining oil prices helped narrow the current account trade deficit but the Bahamas remained dependent on imports.

The Bahamas Oil Refining Co. (BORCO), with a capacity of 350,000 barrels per day, remained closed. Chevron Oil Bahamas Ltd. and Charter Oil Co., joint owners of the refinery, reached an agreement in 1987 whereby Chevron would assume full ownership in return for canceling the financially troubled Charter's debts to Chevron. No monies were involved in the transfer. Chevron was not expected to reopen the refinery in the near future. The terminal facilities remained open and were used for the transshipment of crude oil and refined products by BORCO. The Bahamas has become an important oil transshipment point to the United States.

The Grand Bahamas Port Authority was considering building a large coal-fired electric generating plant in Freeport. The plant would use an underwater cable to connect with Florida Light and Power Co.'s transmission facilities in southern Florida. Freeport was considered a good location because of the proximity to southern Florida; its deep-water bunkering capacity would allow access to imported, low-cost, low-sulfur coal as well as the Bahamas tax advantage. Other advantages would be the reduction in the cost of electricity in the Bahamas and the opportunity to employ 1,000 workers.

Puerto Rico ordered Umar Cement Co., a major importer of cement from the Bahamas, Morocco, and Spain to stop construction of a 500-ton storage silo for cement. The project apparently lacked the necessary permits and was opposed by other cement companies who maintained that Umar contributed to the importation of cement from overseas. In 1987, Umar imported about 7,000 tons of cement from the Bahamas into Puerto Rico.

BARBADOS[4]

Real economic growth was estimated at about 2%. This was the fifth successive year of expansion in the Barbados economy and the third highest rate of growth since 1981. This economic growth was mainly attributed to tourism. Manufacturing output decreased and crude oil output continued its declining trend. The Barbados National Oil Co. Ltd. (BNOC) continued its policy of restricted exploration and production because of low world oil prices. As a result, crude oil and natural gas production fell by 11% and 15%, respectively.

Output at the Woodbourne Oilfields amounted to 497,000 barrels of crude oil and production of natural gas declined to 1,042 million cubic feet. The reduced oil and gas production resulted in increased fuel imports. Crude oil reserves at yearend were estimated at slightly over 3 million barrels. Estimated gas reserves were 6.6 billion cubic feet.

Cluff Oil Ltd. of the United Kingdom halted petroleum exploration efforts after completion of its first phase of exploration. The reasons given were low oil prices and the depth of water, which was over 2,000 feet. Cluff has exclusive exploration-production rights for a 400-square-mile block off Barbados' northwestern coast. As a result, the Government intended to commence a major onshore drilling program in 1988.

The Government was seeking to make Barbados more self-sufficient in energy and was encouraging alternate energy projects such as solar water heaters and wind-driven electric generators.

In 1987, BNOC purchased a natural gas liquid (NGL) processing plant through a loan of $2 million[5] from the Export Development Corp. of Canada and local funding of $1.4 million. The NGL plant has a capacity of 4.5 to 5 million cubic feet per day. At throughput levels of 3 million cubic feet per day, the plant will replace about 25% of imports of light-fraction petroleum products such as butane and propane. The plant will be situated near the Woodbourne Oilfields on the southeastern coast.

The Arawak Cement Co. Ltd.'s plant, which had never operated at top efficiency, was shut down in 1987 for repairs. Built in 1984 at a cost of $100 million, the financially troubled plant has had problems competing with other regional cement pro-

ducers. Two Puerto Rican cement producers filed an informal antidumping petition with the U.S. International Trade Commission alleging that Arawak sold cement in the Puerto Rican market at substantially lower prices than those charged in Barbados.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Scrap	20	6	--	All to West Germany.
Semimanufactures				
value, thousands	$12	$1	$1	
Copper: Metal including alloys:				
Scrap	53	16	16	
Semimanufactures	42	--		
Iron and steel: Metal:				
Scrap	391	NA		
Semimanufactures:				
Bars, rods, angles, shapes, sections	4,814	NA		
Universals, plates, sheets	39	8	--	All to Antigua and Barbuda.
Wire	NA	247	246	Antigua and Barbuda.
Tubes, pipes, fittings	NA	1	1	
Lead:				
Oxides	9	5	--	All to Guyana.
Metal including alloys:				
Scrap	--	120	--	All to Trinidad and Tobago.
Semimanufactures				
value, thousands	$24	--		
Nickel: Metal including alloys, scrap				
do	$3	--		
Silver: Waste and sweepings				
kilograms	73	NA		
Tin: Metal including alloys, semimanufactures value, thousands	$2	--		
Zinc: Oxides	--	1	--	All to Trinidad and Tobago.
Other: Ashes and residues	16	--		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Unspecified	--	1	--	All to Grenada.
Asbestos, crude	1	--		
Cement	NA	153,213	47,526	Netherlands Antilles 15,898; Jamaica 14,300.
Fertilizer materials: Manufactured:				
Ammonia value, thousands	$4	$4	--	Dominica $2; St. Lucia $1; St. Vincent and Grenadines $1.
Nitrogenous	2	--		
Phosphatic	2	--		
Potassic value, thousands	$7	$1	--	All to St. Lucia.
Unspecified and mixed	NA	375	--	Mainly to St. Lucia.
Gypsum and plaster	40	339	--	NA.
Pigments, mineral: Iron oxides and hydroxides, processed	--	1	1	
Stone, sand and gravel:				
Dimension stone, worked	NA	41	--	Grenada 29; Trinidad and Tobago 6; Antigua and Barbuda 2.
Gravel and crushed rock	51	822	--	Trinidad and Tobago 800; St. Lucia 5.
Unspecified	--	30,047	--	Guadeloupe 22,600; Trinidad and Tobago 7,047; St. Vincent and Grenadines 280.
Talc, steatite, soapstone, pyrophyllite	--	1	--	All to Jamaica.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	1	NA		
Coal: All grades excluding briquets	1	--		
Coke and semicoke	30	--		
Petroleum refinery products:				
Gasoline, motor, 42-gallon barrels	60	14,688	--	NA.
Mineral jelly and wax do	39	31	--	St. Lucia 16; Grenada 8; St. Vincent and Grenadines 7.
Kerosene and jet fuel do	NA	623,759	--	United Kingdom 36,731; St. Vincent and Grenadines 3,488; unspecified 583,900.
Distillate fuel oil do	NA	323,779	3,335	Guyana 61,746; Greece 918; unspecified 257,780.
Lubricants do	NA	91	--	St. Christopher and Nevis 14; Jamaica 5; Mexico 4.
Residual fuel oil do	1,209,956	912,007	1,372	Guyana 425,281; Greece 2,404; unspecified 482,950.

NA Not available.

[1]Table prepared by H. D. Willis.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	10	6	(2)	United Kingdom 4; West Germany 1.
Metal including alloys, semimanufactures	147	6,447	6,099	Belgium-Luxembourg 274; United Kingdom 62.
Columbium and tantalum: Metal including alloys, all forms: Tantalum	1	1	1	
Copper: Metal including alloys, semimanufactures	48	3,841	770	United Kingdom 3,054; Canada 14.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	--	996	--	All from Venezuela.
Metal:				
Pig iron, cast iron, related materials	393	2,108	1	Trinidad and Tobago 1,160; Venezuela 942; West Germany 5.
Ferromanganese	7,006	--		
Steel, primary forms	2,863	--		
Semimanufactures:				
Bars, rods, angles, shapes, sections	31,912	8,455	84	Trinidad and Tobago 5,470; United Kingdom 2,317; Belgium-Luxembourg 233.
Universals, plates, sheets	15,449	13,334	135	United Kingdom 10,888; Belgium-Luxembourg 1,009; Japan 617.
Hoop and strip	3	72	48	Belgium-Luxembourg 11; United Kingdom 10.
Rails and accessories	1	9	2	United Kingdom 7.
Wire	NA	201	23	United Kingdom 121; Belgium-Luxembourg 40.
Tubes, pipes, fittings	NA	40,336	1,656	United Kingdom 16,740; Republic of Korea 14,447; Japan 4,100.
Castings and forgings, rough	9	3	2	Canada 1.
Lead:				
Oxides	79	58	18	Trinidad and Tobago 39; West Germany 1.
Metal including alloys, semimanufactures	15	36	6	United Kingdom 30.
Magnesium: Metal including alloys, semimanufactures	--	2	(2)	Mainly to United Kingdom.
Nickel: Metal including alloys, semimanufactures	2	2	1	United Kingdom 1.
Silver:				
Waste and sweepings, value, thousands	$1,194	$847	$841	Philippines $6.
Metal including alloys, unwrought and partly wrought, do.	$1	$1	$1	
Tin: Metal including alloys:				
Unwrought, do.	$4	--		
Semimanufactures	532	550	435	France 92; Japan 20.
Titanium: Oxides	244	595	91	United Kingdom 449; Norway 18.
Zinc:				
Oxides	16	26	5	United Kingdom 15; Belgium-Luxembourg 4.
Metal including alloys, semimanufactures	15	959	55	Canada 863; United Kingdom 41.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	NA	6	2	United Kingdom 4.
Grinding and polishing wheels and stones	7	7	2	Switzerland 2; Canada 1.
Asbestos, crude	4	898	898	
Barite and witherite	2,058	685	685	
Boron materials: Crude natural borates, value, thousands	--	$1	--	All from United Kingdom.
Cement, do.	$502	$204	$91	Spain $56; Belgium-Luxembourg $31.
Chalk	400	6	--	All from United Kingdom.
Clays, crude	NA	1,152	104	United Kingdom 1,031; Belgium-Luxembourg 13.
Diatomite and other infusorial earth	24	54	52	United Kingdom 2.
Fertilizer materials: Manufactured:				
Ammonia	NA	13	2	United Kingdom 10; Netherlands 1.
Phosphatic	NA	123	63	Netherlands 50; United Kingdom 6.
Unspecified and mixed	NA	2,408	77	Netherlands 1,298; Dominican Republic 547; West Germany 311.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Gypsum and plaster	6,678	8,296	36	Jamaica 5,116; Dominican Republic 3,000; United Kingdom 144.
Lime	NA	640	--	All from United Kingdom.
Mica:				
Crude including splittings and waste	NA	9,386	4,544	Sweden 4,800; Norway 42.
Worked including agglomerated splittings	1	2	2	
Phosphates, crude	376	386	266	Belgium-Luxembourg 120.
Pigments, mineral: Iron oxides and hydroxides, processed	20	24	7	West Germany 7; United Kingdom 5.
Salt and brine value, thousands	$376	$327	$37	Canada $197; Jamaica $61.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	108	88	24	Italy 62; United Kingdom 1.
Worked	NA	50	41	Canada 5; Italy 1.
Gravel and crushed rock	NA	35,256	60	Canada 35,195; United Kingdom 1.
Sand other than metal-bearing	NA	144	95	NA.
Sulfur: Sulfuric acid	197	71	34	Netherlands 32; West Germany 5.
Talc, steatite, soapstone, pyrophyllite	NA	236	210	Norway 23; West Germany 2.
Other:				
Crude	--	69	62	United Kingdom 7.
Slag and dross, not metal-bearing	--	5,719	19	Venezuela 5,700.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	--	6	1	United Kingdom 5.
Carbon black	76	13	4	United Kingdom 6; Canada 3.
Coal:				
Briquets of anthracite and bituminous coal	110	NA		
Lignite including briquets	--	18	18	
All grades excluding briquets value, thousands	$7	$9	$8	Canada $1.
Coke and semicoke	--	5	--	All from Belgium-Luxembourg.
Peat including briquets and litter value, thousands	$30	$53	$1	Denmark $15; Ireland $14; Canada $8.
Petroleum:				
Crude 42-gallon barrels	--	119	119	
Refinery products:				
Liquefied petroleum gas do	115,118	111,580	4,501	Trinidad and Tobago 75,017; Netherlands Antilles 19,105; Venezuela 12,853.
Gasoline, motor do	6,248	5,032	--	Trinidad and Tobago 2,338; Venezuela 1,708; Guatemala 986.
Mineral jelly and wax do	559	1,055	252	Brazil 417; United Kingdom 181.
Kerosene and jet fuel do	1,028,820	NA		
Distillate fuel oil do	NA	278,176	--	Venezuela 221,584; Trinidad and Tobago 38,150.
Lubricants do	84	119	105	United Kingdom 7.
Residual fuel oil do	1,758,014	1,473,845	--	Venezuela 1,075,750; Trinidad and Tobago 212,048; Andorra 125,241.

NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.

CUBA[6]

At yearend, the Government of Cuba reported that, by September, total commodity production had reached 72% of the year's plan. The production of asbestos roof gutters, gray cement, gypsum, crushed stone, hydrated lime, and concrete sewage pipes exceeded the plan. The plan was met in the production of concrete blocks, clay bricks, and asbestos cement roof tiles. Imports decreased 7% and exports increased 9%. The Government reported the policy of import reduction from market economy countries to be a success, resulting in a 50% reduction in import expenditures. Imports from centrally planned economy countries increased slightly.

In 1987, Cuba signed a new trade agreement with The German Democratic Republic, its second largest trading partner. Reportedly, the new agreement represents an 8% increase in trade from that of 1986. Under the agreement, Cuba was to export a variety of commodities, including nickel, to the German Democratic Republic. For the first time, the agreement contained items such as trucks, hydraulic cylinders, sugar

industry equipment, and spare parts.

During the year, Cuba also signed trade and economic agreements with Cyprus and Peru, respectively, and held meetings with Brazil, after renewing diplomatic relations with Brazil in 1986. In April, Brazil's Ministry of Transportation announced that cooperation agreements between Cuba and Brazil would be signed relating to the automotive, maritime, rail, and air transport industries. Also in April, Yugoslavia signed a trade agreement with Cuba.

The National Labor Union Commission was formed. The union will deal with matters that relate to income, costs, and profits of enterprises as a response to the Government's efforts to eliminate unprofitability in Cuban enterprises.

On December 17, the sixth plenum of the Cuban Communist Party Central Committee was held. In the meeting, the 1987 social and economic accomplishments were summarized and the 1988 budget was presented and approved. The 1988 program and budget were based on a 2% to 3% increase in growth from that of 1987. The plan called for the currency in circulation to be limited to 1987 levels. Reportedly, the 1988 plan was to pay special attention to mineral prospecting, metallurgy of ferrous and nonferrous metals, and the oil industries, among other sectors.

Cimex S.A., a Cuban-Panamanian precious metals company, obtained Government permission to buy gold and silver bullion, jewelry, and other items from Cuban citizens in return for Government-approved bonds that could then be exchanged for consumer goods in Havana.

Mining continued to be a small but important sector of Cuba's economy. Expansion efforts continued in the nickel, marble, steel, and oil industries. Cuba was to invest $500 million[r] in the expansion of its principal steelworks, Empresa Metalúrgica José Martí in Havana during the year. When completed, the expansion would increase raw steel capacity from 350,000 to 600,000 tons per year. Initiated in 1981 with assistance from the U.S.S.R., the expansion was scheduled for completion in 1988-89. Cuba exported steel bars, billets, ingots, and wire rods to Asia, Latin America, and the Middle East.

Cuba ranks fourth in world nickel reserves, after Canada, the U.S.S.R., and the Republic of South Africa. In 1987, production of nickel-cobalt content of mine output increased slightly to 35,800 tons. During the year, efforts were made to bring one of three production lines at the Punta Gorda smelter to its full 10,000-ton design capacity. The second line, previously scheduled for completion during the year, had to be postponed.

The Punta Gorda nickel refinery, inaugurated early in 1986, produced only 1,200 tons of nickel that year, and production was reportedly still not up to standard by year-end 1987. Nickel extraction in the smelter is by the ammonia process. The product output has been complicated by the ore's high content of chrome, cobalt, and iron. Because of technical problems with the Punta Gorda refinery, commissioning of Las Camariocas refinery has been delayed and was expected no sooner than 1995. Government nickel production goals have been revised down to 60,000 tons per year in 1990 and 100,000 tons per year by 2000.

A storage facility with a throughput of almost 195,000 tons of ammonia per year was under construction in the Province of Camagüey. It will be the first installation of its kind in Cuba. The first stage consists of two tanks 23 meters in height and 29 meters in diameter each. The tanks, constructed with technical assistance from Spain, each will have a capacity of 10,000 tons of ammonia. Plans call for two additional tanks to be built by the U.S.S.R. Reportedly, refrigerated ammonia will be delivered to Cuba by 8,000-ton Soviet cargo ships. Approximately 45% of the ammonia will be utilized by the Revolución de Octubre fertilizer complex in Nuevitas. The remainder will be used in nickel and rayon processing. The first tank was scheduled for completion in January 1988 and the first ammonia shipment for March of the same year. A 19-kilometer pipeline will link the storage facility to the fertilizer complex.

The quarry of marble continued to be an important operation for Cuba in 1987. Marble deposits are found south of Cuba in the Isla de la Juventud (formerly known as Isla de Pinos). In the western region, marble deposits are in the Pinar del Río Province and in the central region the deposits are in the Provinces of Cienfuegos and Villa Clara. In the eastern region, marble is found in the subsoil in the Granma Province. Cuba exports nine varieties of marble.

A new marble complex, under construction since 1985 in Mariel, Havana Province, reportedly, was completed in July 1987. The complex, equipped with Italian-made equipment was to receive marble from Cienfuegos, Isla de la Juventud, Pinar del Río, and Villa Clara to produce marble tiles and dimension stone used in building facades. A large portion of the marble output was planned for export.

Table 4.—Cuba: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal destinations, 1986
METALS			
Aluminum:			
Ash and residue containing aluminum	578	364	Netherlands 362; Spain 2.
Metal including alloys:			
Scrap	4,760	4,161	Netherlands 4,100; Spain 61.
Unwrought	NA	90	All to Netherlands.
Semimanufactures	17	2	Do.
Chromium: Ore and concentrate	[2]41,607	[2]37,826	Czechoslovakia 20,000; Argentina 2,004; Canada 1,040.
Copper:			
Ore and concentrate[2]	3,118	2,621	NA.
Matte and speiss including cement copper	32	NA	NA.
Ash and residue containing copper	502	163	All to Netherlands.
Metal including alloys:			
Scrap	7,675	6,451	Netherlands 6,165; Spain 269; West Germany 17.
Unwrought	NA	70	All to Netherlands.
Iron and steel: Metal:			
Scrap	116,829	111,035	Italy 60,206; Greece 49,663; Netherlands 1,062.
Pig iron, cast iron, related materials	24	NA	
Ferronickel	39	NA	
Steel, primary forms	22,514	8,080	All to Italy.
Semimanufactures	[2]95,870	[2]115,231	Italy 1,939.
Lead: Metal including alloys, all forms	540	146	All to Netherlands.
Nickel:			
Matte and speiss	2,126	959	Italy 584; Japan 125; Yugoslavia 56.
Oxides and hydroxides, Ni content[2 3]	9,165	8,918	Czechoslovakia 3,207; U.S.S.R. 2,255; Italy 1,007.
Sinter, Ni content[2 3]	6,657	7,991	West Germany 2,099; East Germany 996; Sweden 912.
Sulfide, Ni content[2 3]	17,594	18,003	All to U.S.S.R.
Metal including alloys, all forms	2,082	301	All to Czechoslovakia.
Tin:			
Ash and residue containing tin	NA	21	All to Netherlands.
Metal including alloys, scrap	15	31	Do.
Titanium: Metal including alloys, all forms	NA	5	West Germany 3; United Kingdom 2.
Vanadium: Ash and residue containing vanadium	177	NA	
Zinc:			
Ash and residue containing zinc	800	674	All to Netherlands.
Metal including alloys, scrap	505	286	Do.
Other:			
Ores and concentrates	NA	8,105	Hungary 7,014; Austria 1,091.
Oxides and hydroxides	3	NA	
Ashes and residues	34	152	All to West Germany.
Base metals including alloys, all forms	NA	5	All to Netherlands.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.: Artificial, corundum	25	NA	
Cement	[2]60,358	[2]68,901	NA.
Mica: Crude including splittings and waste	NA	503	All to United Kingdom.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	35	3,530	Hungary 3,181; Italy 341; Spain 8.
Worked	NA	12	All to Spain.
Sand other than metal-bearing	48	NA	
Sulfur: Sulfuric acid	NA	3,063	All to Netherlands.
Other: Crude	NA	18	All to Spain.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude thousand 42-gallon barrels	1,957	885	Spain 821; Italy 64.
Refinery products: Gasoline, motor do	1,605	974	United Kingdom 536; West Germany 255; France 183.

[p]Preliminary. NA Not available.

[1]Table prepared by H. D. Willis. Owing to a lack of official trade data published by Cuba, this table should not be taken as a complete presentation of this country's mineral trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries. The United States reported no trade in mineral commodities with Cuba in 1985 or 1986.

[2]Anuario Estadistico de Cuba, 1986.

[3]Includes contained cobalt.

Table 5.—Cuba: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal sources, 1986
METALS			
Aluminum:			
Oxides and hydroxides	1,149	1,024	All from Japan.
Metal including alloys:			
Unwrought	29	30	All from United Kingdom.
Semimanufactures	4,750	3,282	Hungary 2,017; Spain 1,178; United Kingdom 37.
Cadmium: Metal including alloys, all forms	NA	2	All from Belgium-Luxembourg.
Chromium: Oxides and hydroxides	59	115	Japan 112; United Kingdom 3.
Cobalt: Oxides and hydroxides value	$5,000	$11,161	All from Japan.
Copper:			
Oxides and hydroxides	NA	123	Belgium-Luxembourg 122; West Germany 1.
Sulfate	NA	138	United Kingdom 118; Yugoslavia 20.
Metal including alloys, semimanufactures	7,717	[2]1,774	Japan 845; Spain 83; Argentina 32.
Gold: Metal including alloys, unwrought and partly wrought value, thousands	$350	$472	Spain $357; West Germany $115.
Iron and steel:			
Iron ore and concentrate excluding roasted pyrite	479	590	All from Netherlands.
Metal:			
Scrap	99,185	88,755	All from U.S.S.R.
Pig iron, cast iron, related materials	120	115	West Germany 114; Spain 1.
Ferroalloys:			
Ferrochromium	NA	5	All from France.
Ferromanganese	1,399	1,348	Japan 1,313; Spain 35.
Unspecified	NA	5	All from Spain.
Steel, primary forms	872	324	Spain 321; Austria 3.
Semimanufactures:			
Bars, rods, angles, shapes, sections	51,764	10,715	Poland 4,236; Spain 2,981; Hungary 1,587.
Universals, plates, sheets[2]	836,837	807,125	U.S.S.R. 639,919; Bulgaria 51,152; Spain 20,649.
Hoop and strip	1,462	617	Japan 326; West Germany 215; Spain 60.
Rails and accessories	NA	199	All from France.
Wire	11,305	5,081	Argentina 1,842; Spain 1,479; United Kingdom 765.
Tubes, pipes, fittings[2]	99,907	97,281	U.S.S.R. 49,954; Bulgaria 15,179; Japan 6,063.
Castings and forgings, rough[2]	237,984	284,210	NA.
Lead:			
Oxides	788	286	All from France.
Metal including alloys:			
Unwrought	4,187	104	Belgium-Luxembourg 102; Netherlands 2.
Semimanufactures	639	476	Belgium-Luxembourg 428; Japan 48.
Magnesium: Metal including alloys:			
Unwrought	21	NA	
Semimanufactures	5	3	Spain 2; United Kingdom 1.
Manganese:			
Ore and concentrate	481	302	All from Netherlands.
Oxides	280	200	All from Japan.
Metal including alloys, all forms	16	2	All from Spain.
Mercury 76-pound flasks	NA	116	Netherlands 87; United Kingdom 29.
Nickel:			
Oxides and hydroxides	NA	33	All from Italy.
Metal including alloys:			
Unwrought	2	2	All from Netherlands.
Semimanufactures	15	26	Japan 12; Canada 7; West Germany 6.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$37	$145	France $59; West Germany $57; Spain $16.
Silver: Metal including alloys, unwrought and partly wrought do	$708	$290	West Germany $162; Spain $110; Japan $17.
Tin: Metal including alloys:			
Unwrought	351	21	Mainly from United Kingdom.
Semimanufactures	2	1	All from Spain.
Titanium:			
Ore and concentrate	NA	123	Do.
Oxides	107	68	West Germany 67; United Kingdom 1.
Metal including alloys, all forms	NA	3	All from Japan.
Tungsten: Metal including alloys, all forms value, thousands	$18	$123	Do.

See footnotes at end of table.

Table 5.—Cuba: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal sources, 1986
METALS —Continued			
Zinc:			
Ore and concentrate	38	NA	
Oxides	450	372	Argentina 209; United Kingdom 163.
Blue powder	1	NA	
Metal including alloys:			
Unwrought	1,884	117	All from Japan.
Semimanufactures	109	331	Japan 293; Netherlands 38.
Other:			
Ores and concentrates	3	30	West Germany 18; Spain 12.
Oxides and hydroxides	33	NA	
Base metals including alloys, all forms	4	NA	
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc	50	50	All from Italy.
Artificial: Corundum	76	126	All from West Germany.
Dust and powder of precious and semiprecious stones value, thousands	$11	NA	
Grinding and polishing wheels and stones	211	223	Austria 205; Spain 9; Yugoslavia 4.
Asbestos, crude	1,659	2,374	All from Canada.
Boron materials: Oxides and acids	2	151	All from Argentina.
Cement	49,082	14,081	U.S.S.R. 13,000; United Kingdom 855; Japan 114.
Clays, crude:			
Bentonite	572	NA	
Chamotte earth	40	NA	
Kaolin	2,793	120	United Kingdom 85; Belgium-Luxembourg 35.
Unspecified	105	145	Spain 127; West Germany 18.
Diatomite and other infusorial earth	4	1	All from West Germany.
Feldspar, fluorspar, related materials	80	NA	
Fertilizer materials: Manufactured:			
Ammonia	[2]39,407	[2]36,000	NA.
Nitrogenous	[2]626,150	[2]607,000	U.S.S.R. 576,000; West Germany 5.
Phosphatic (total)	295,466	348,515	U.S.S.R. 312,000; Tunisia 36,515.
Of which:			
Superphosphate, simple[2]	255,466	299,000	NA.
Superphosphate, triple[2]	40,000	37,000	NA.
Unspecified	NA	12,515	NA.
Potassic (total)	414,874	385,000	U.S.S.R. 232,000; West Germany 27.
Of which:			
Potassium chloride[2]	390,593	367,000	NA.
Potassium sulfate[2]	24,281	18,000	NA.
Unspecified and mixed	534	NA	
Fluorspar	134	NA	
Graphite, natural	512	162	Japan 160; Spain 2.
Gypsum and plaster	147	457	United Kingdom 357; West Germany 100.
Iodine	NA	4	Netherlands 3; Spain 1.
Lime	NA	4	All from Japan.
Magnesium compounds:			
Magnesite, crude	NA	243	Austria 242; West Germany 1.
Oxides and hydroxides	52	NA	
Mica:			
Crude including splittings and waste	339	140	France 108; Spain 21; Argentina 11.
Worked including agglomerated splittings	1	6	Japan 4; Italy 1; United Kingdom 1.
Phosphates, crude	10,000	NA	
Phosphorus, elemental	NA	12	All from Japan.
Pigments, mineral:			
Natural, crude	NA	1	All from West Germany.
Iron oxides and hydroxides, processed	569	283	Spain 184; Japan 99.
Precious and semiprecious stones other than diamond:			
Natural value	$400	NA	
Synthetic do	$25,000	$57,908	Japan $27,908; Switzerland $23,000; Austria $7,000.
Salt and brine	66	124	West Germany 114; United Kingdom 10.
Sodium compounds, n.e.s.:			
Carbonate, manufactured	6,858	5,010	France 5,001; West Germany 9.
Sulfate, manufactured	1,084	NA	

See footnotes at end of table.

Table 5.—Cuba: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal sources, 1986
INDUSTRIAL MINERALS —Continued			
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	2	151	Spain 150; Italy 1.
Worked	NA	12	Italy 6; Spain 6.
Gravel and crushed rock	NA	135	All from France.
Quartz and quartzite	47	8	All from West Germany.
Sand other than metal-bearing	2	103	Yugoslavia 102; West Germany 1.
Sulfur:			
Elemental, all forms	[2]157,061	[2]124,535	Canada 61,616.
Sulfuric acid	37	14	All from United Kingdom.
Talc, steatite, soapstone, pyrophyllite	57	NA	
Other: Crude	453	281	Spain 280; West Germany 1.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	8	8	All from Spain.
Carbon black	4,980	196	West Germany 139; United Kingdom 52; Japan 5.
Coal:			
Anthracite	[2]89,718	[2]83,113	Japan 200.
All other grades including briquets	1,300	NA	
Coke and semicoke	[2]63,849	[2]62,263	Japan 27.
Peat including briquets and litter	144	283	West Germany 282; Canada 1.
Petroleum:			
Crude thousand 42-gallon barrels	[2]58,736	NA	
Refinery products:			
Liquefied petroleum gas 42-gallon barrels	NA	12	All from West Germany.
Gasoline, motor do	[2]3,267,154	215,009	Canada 214,481; United Kingdom 366; West Germany 162.
Mineral jelly and wax do	162	4,305	Japan 3,738; Netherlands 409; United Kingdom 142.
Kerosene and jet fuel do	85	113,871	Spain 67,255; Netherlands 46,500; Yugoslavia 116.
Distillate fuel oil do	[2]25,519,302	84,939	Canada 84,581; Yugoslavia 336; West Germany 15.
Lubricants do	[2]758,758	[2]597,100	Italy 57,680; Netherlands 57,197; Spain 38,801.
Nonlubricating oils do	28	79	All from Japan.
Residual fuel oil do	[2]8,733,251	199,707	All from Spain.
Bitumen and other residues do	127	NA	
Bituminous mixtures do	1,369	431	United Kingdom 261; Spain 158; Yugoslavia 6.
Petroleum coke do	110	127	All from West Germany.

[p]Preliminary. NA Not available.

[1]Table prepared by H. D. Willis. Owing to a lack of official trade data published by Cuba, this table should not be taken as a complete presentation of this country's mineral trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries. The United States reported no trade in mineral commodities with Cuba in 1985 or 1986.

[2]Anuario Estadistico de Cuba, 1986.

Another marble complex was under construction in San Francisco, Granma Province. Designed to be Cuba's largest, it was scheduled for completion in the 1986-90 plan period. At full capacity, the new plant would exceed the combined capacity of the Mariel and Nueva Gerona plants. About 90% of the plant's production was to be exported, mostly to hard-currency markets. The Granma area has been producing marble since the 1950's.

Testing was begun at the Combine Two complex of the new oil refinery in Santiago. The test included the processing of crude to produce naphtha, diesel oil, kerosene, fuel oil, oil tar, and other products. The Combine Two complex was scheduled for completion during the first half of 1988.

To ensure adequate fuel supply to the country, Cuba was planning to construct, with Soviet assistance, a 200-kilometer pipeline from the new oil terminal in Matanzas, east of Havana, to the new oil refinery in Cienfuegos. The project includes building a school to train workers who will operate and maintain the pipeline. The schedule calls for construction of branch pipelines and fuel storage warehouses to be built by 1990. The 1987 plans included the completion of 66 kilometers of pipeline to carry fuel oil to the thermoelectric plants in Matanzas and Santa Cruz del Norte and Cuban crude oil from Varadero to the Port of Cárdenas.

DOMINICAN REPUBLIC[8]

The Dominican Republic has known mineral deposits of bauxite, coal, copper, gold, gypsum, iron ore, limestone, marble, nickel, and silver. Titanium sands have been found in various places on the sea coasts. Cobalt, molybdenum, and other minerals have been found in small quantities. Mining activity in the Dominican Republic continued to be centered around gold and nickel.

To encourage foreign investment in the mining industry, the Government of the Dominican Republic enacted Decree No. 13-87 in January 1987, replacing all previous decrees that had set aside national mineral reserves areas that contain base metals, gold, silver, and others. Previously, the national reserves could be explored by private companies but developed only by the Government or with special contracts. Those policies had produced a negative impact on the industry by almost paralyzing mineral exploration by private companies. The new 1987 decree opened most of the territory to exploration by private domestic companies and foreign companies by opening up most of the national reserves. The greater part of the country will be governed by the 1971 Mining Law No. 146, which provides for prospecting, exploration, development, and exploitation of mineral deposits in the Dominican Republic. The new decree maintains only four national reserves: Sabaneta, 55,700 hectares; Pueblo Viejo Extension, 46,000 hectares; Neita, 25,200 hectares; and La Cuaba, 2,100 hectares. Reportedly, because of the new mining policies, companies from Australia, Canada, Japan, and the United States indicated interest, primarily exploring for precious metals.

Relative to 1986, the economy of the Dominican Republic grew at a rate of 8% in 1987. Construction led the growth with a 46% increase, followed by mining with 16%. Growth in the value of mineral output was attributed to increases in prices rather than increased production. Economic growth was accompanied by a sharp increase in imports. According to the Central Bank, inflation increased by 25%, leading to a peso depreciation of 38%. As a consequence, the Government imposed strict exchange control in June, which was then removed in November.

Gold production in 1987 from the Pueblo Viejo Mine, operated by Rosario Dominicana S.A., was 246,400 troy ounces. This output from the oxide ore zone was expected to decrease further in 1988 and to cease because of total depletion in 1990. The other two ore zones, transition and sulfide, reportedly contain 400,000 and 10,000,000 ounces of gold, respectively. In 1987, the mine's board of directors approved funds to develop the transition ore zone but Government approval had not been granted at yearend. Canyon Resources Inc., a U.S. company, found commercially exploitable gold deposits near the Pueblo Viejo Mine.

Mitsubishi Corp. was interested in forming a joint venture with Rosario Dominicana to develop the Loma de la Nandina gold prospect. Mitsubishi previously had been involved in gold exploration in the Dominican Republic.

According to the 1987 report of Falconbridge Dominicana, production of nickel in ferronickel reached a record-high level of 32,521. The company reported net earnings of $13.4 million[9] after suffering a net loss of $2.2 million in 1986 and attributed the improved earnings to high production rates and improved nickel prices.

In November, the Government issued decree No. 578-87 establishing export duties on sugar and minerals, including ferronickel, to be imposed when the official foreign exchange rate exceeds RD$4.00 to US$1.00. At yearend, according to Falconbridge Dominicana's annual report, the application of this rule represented a duty of 20% of the value of ferronickel shipped during this year. Falconbridge Dominicana argued that its Supplementary Agreement of 1969 with the Government could not be unilaterally amended by Presidential decree and made no payment of duties, suspending shipments in December.

The Dirección General de Minas reopened the Cabo Rojo Mine during the year. Ideal Dominicana S.A. managed this bauxite mine for the Government, which produced 211,000 tons and exported 285,700 tons including bauxite from the Aluminum Co. of America (Alcoa) stockpile. Production was sold to Alcoa, the mine operator from 1959 to 1983.

Table 6.—Dominican Republic: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	99	65	10	Brazil 37; West Germany 18.
Metal including alloys:				
Scrap	41	--		
Unwrought	1,350	1,010	969	Canada 41.
Semimanufactures	1,834	2,484	543	Spain 814; West Germany 516.
Arsenic: Oxides and acids	18	--		
Chromium: Oxides and hydroxides	2	3	--	All from West Germany.
Cobalt: Oxides and hydroxides	1	1	--	All from United Kingdom.
Copper: Metal including alloys:				
Unwrought	50	2	2	
Semimanufactures	1,253	1,293	943	Canada 147; Chile 117.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	--	34	34	
Pyrite, roasted	--	2	2	
Metal:				
Scrap	50,372	20,071	18,497	Netherlands Antilles 1,028; Haiti 545.
Pig iron, cast iron, related materials	56	100	--	Japan 98; Brazil 2.
Ferroalloys:				
Ferromanganese	85	321	71	Brazil 250.
Unspecified	841	748	--	Brazil 691; Canada 53; Japan 4.
Steel, primary forms	49,574	11,632	52	Venezuela 9,895; Republic of Korea 1,015; Spain 349.
Semimanufactures:				
Bars, rods, angles, shapes, sections	13,239	15,776	515	Republic of South Africa 4,355; Brazil 1,844; West Germany 1,820.
Universals, plates, sheets	43,061	37,703	5,518	Japan 7,691; West Germany 5,530.
Hoop and strip	367	301	119	Netherlands 57; West Germany 47.
Rails and accessories	131	871	169	United Kingdom 580; Suriname 121.
Wire	607	2,676	69	West Germany 1,848; Belgium-Luxembourg 326; Japan 190.
Tubes, pipes, fittings	1,942	2,132	985	Japan 407; Republic of Korea 317.
Castings and forgings, rough	159	238	98	Spain 44; Belgium-Luxembourg 30.
Lead:				
Ore and concentrate	1	--		
Oxides	652	793	8	Mexico 784.
Metal including alloys:				
Scrap	--	1	1	
Unwrought	57	35	35	
Semimanufactures	1	2	1	West Germany 1.
Magnesium: Metal including alloys, unwrought	--	21	--	All from France.
Manganese:				
Ore and concentrate	537	453	84	Mexico 209; Belgium-Luxembourg 120.
Oxides	24	91	7	Belgium-Luxembourg 70; West Germany 12.
Mercury 76-pound flasks	--	4	(2)	Mainly from West Germany.
Molybdenum: Metal including alloys, all forms value, thousands	--	$3	$3	
Nickel:				
Matte and speiss	--	1	1	
Metal including alloys, semimanufactures	1	3	1	Unspecified 2.
Rare-earth metals including alloys, all forms	474	2,608	1,960	Brazil 330; France 162.
Silver:				
Metal including alloys, unwrought and partly wrought value, thousands	$75	$30	$30	
Tin:				
Oxides	10	--		
Metal including alloys:				
Scrap	39	--		
Unwrought	25	19	14	Unspecified 5.
Semimanufactures	17	53	41	West Germany 10.
Titanium: Oxides	980	902	785	West Germany 97; France 10.

See footnotes at end of table.

Table 6.—Dominican Republic: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS —Continued				
Tungsten: Metal including alloys, all forms	(2)	5	5	
Zinc:				
Oxides	154	124	47	West Germany 46; Netherlands 24.
Blue powder	51	89	24	Mexico 65.
Metal including alloys:				
Scrap	--	50	--	All from Canada.
Unwrought	1,047	1,434	304	Mexico 658; Canada 433.
Semimanufactures	98	136	18	Spain 96; Canada 22.
Other:				
Ores and concentrates	9	97	38	Mexico 59.
Oxides and hydroxides	110	59	48	West Germany 6; Belgium-Luxembourg 5.
Ashes and residues	2	14	14	
Base metals including alloys, all forms	16	18	4	Belgium-Luxembourg 8; West Germany 4.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	203	188	150	West Germany 13; Brazil 9.
Artificial: Corundum	--	23	--	All from Brazil.
Grinding and polishing wheels and stones	104	114	27	Brazil 35; Spain 23.
Asbestos, crude	462	641	20	Canada 621.
Barite and witherite				
value, thousands	--	$24	$10	West Germany $14.
Boron materials:				
Crude natural borates	15	53	53	
Oxides and acids	23	93	67	West Germany 25; Spain 1.
Cement	7,999	11,031	65	Spain 8,405; Mexico 1,721; Republic of Korea 800.
Chalk	238	30	30	
Clays, crude	2,099	2,798	2,153	United Kingdom 590; West Germany 51.
Diatomite and other infusorial earth	587	648	570	Mexico 78.
Feldspar, fluorspar, related materials	1,946	2,190	1,690	Canada 500.
Fertilizer materials:				
Crude, n.e.s	41	3	3	
Manufactured:				
Ammonia	74	149	129	West Germany 14; Netherlands 5.
Nitrogenous	44,143	65,962	58,864	Trinidad and Tobago 6,778; West Germany 276.
Phosphatic	17,000	8,921	8,921	
Potassic	18,517	11,534	11,256	Jamaica 227; West Germany 47.
Unspecified and mixed	31,779	25,217	24,692	Israel 500; West Germany 19.
Graphite, natural	227	106	106	
Gypsum and plaster	73	93	17	Spain 57; West Germany 18.
Magnesite, crude	143	6	--	Italy 4; West Germany 2.
Mica:				
Crude including splittings and waste	--	21	21	
Worked including agglomerated splittings	14	26	7	Japan 6.
Nitrates, crude	--	3	3	
Phosphates, crude	--	52	52	
Pigments, mineral:				
Natural, crude	159	181	8	Belgium-Luxembourg 135; West Germany 17; Hong Kong 11.
Iron oxides and hydroxides, processed	47	88	6	West Germany 68; United Kingdom 13.
Potassium salts, crude	1	--		
Pyrite, unroasted	--	217	--	All from Mexico.
Salt and brine	85	144	126	West Germany 7; Spain 1.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	1,264	1,483	23	West Germany 700; Belgium-Luxembourg 362; France 286.
Sulfate, manufactured	26,731	9,606	4,433	Colombia 1,639; Jamaica 1,205.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked value, thousands	--	$1	$1	
Worked	--	4	3	Italy 1.
Gravel and crushed rock	40	(2)	(2)	
Quartz and quartzite	25	101	98	NA.
Sand other than metal-bearing	793	798	792	Canada 6.

See footnotes at end of table.

Table 6.—Dominican Republic: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur:				
Elemental:				
Crude including native and byproduct	17	1,309	1,303	West Germany 6.
Colloidal, precipitated, sublimed	541	67	67	
Dioxide value, thousands	--	$1	$1	
Sulfuric acid	197	97	97	
Talc, steatite, soapstone, pyrophyllite	1,284	858	738	Italy 75; Spain 32.
Other:				
Crude	14	17	7	United Kingdom 10.
Slag and dross, not metal-bearing	--	2	2	
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,621	--		
Carbon:				
Carbon black	126	94	19	West Germany 51; Belgium-Luxembourg 24.
Gas carbon	143	38,050	20	Venezuela 24,000; Colombia 14,030.
Coal: All grades excluding briquets value, thousands	$893	$5,601	$42	Colombia $5,085; India $466.
Coke and semicoke	21,378	198	--	All from Colombia.
Petroleum:				
Crude thousand 42-gallon barrels	12,565	12,051	1	Venezuela 8,676; Mexico 3,352; Netherlands Antilles 21.
Refinery products:				
Liquefied petroleum gas do	596	398	45	Venezuela 353.
Gasoline, motor do	49	75	3	Venezuela 67; Netherlands Antilles 5.
Mineral jelly and wax do	26	27	5	Japan 15; West Germany 6.
Kerosene and jet fuel do	8	10	5	Venezuela 3; Netherlands Antilles 2.
Distillate fuel oil do	681	135	--	All from Venezuela.
Lubricants do	102	118	42	Netherlands Antilles 35; Venezuela 33.
Nonlubricating oils do	3	2	2	
Residual fuel oil do	3,174	2,610	--	Venezuela 2,605; Panama 5.
Bitumen and other residues do	80	56	8	Panama 29; Netherlands Antilles 15; Haiti 4.
Bituminous mixtures do	3	40	2	Panama 38.
Petroleum coke do	32	69	69	

NA Not available.
[1]Table prepared by H. D. Willis. Export data were not available at time of publication.
[2]Less than 1/2 unit.

GUADELOUPE AND MARTINIQUE

The latest trade data available for Guadeloupe and Martinique are included in the following tables.

Table 7.—Guadeloupe: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Principal destinations, 1986
METALS			
Aluminum: Metal including alloys:			
Scrap	124	85	All to France.
Semimanufactures	17	29	Martinique 28; France 1.
Copper: Metal including alloys:			
Scrap	--	297	France 263; Belgium-Luxembourg 23; West Germany 11.
Semimanufactures	1	1	Mainly to St. Lucia.
Iron and steel: Metal:			
Scrap	134	6	All to Brazil.
Semimanufactures:			
Bars, rods, angles, shapes, sections	129	68	Martinique 33; French Guiana 26.
Universals, plates, sheets	20	15	Martinique 8; Barbados 5; St. Lucia 2.
Wire value, thousands	$2	--	
Tubes, pipes, fittings	29	7	French Guiana 5; Barbados 1; Martinique 1.
Castings and forgings, rough	--	5	All to Martinique.
Lead: Metal including alloys, unwrought	19	--	
Nickel: Metal including alloys, scrap	16	--	
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$1	--	
Zinc: Oxides	--	5	All to Martinique.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.: Natural: Corundum, emery, pumice, etc value, thousands	$4	--	
Cement	13,632	11,586	French Guiana 6,198; Dominica 4,861; Barbados 230.
Fertilizer materials: Manufactured:			
Ammonia	69	51	All to Martinique.
Unspecified and mixed	--	1,120	St. Lucia 850; Grenada 250; French Guiana 20.
Salt and brine	1	(2)	All to French Guiana.
Stone, sand and gravel:			
Gravel and crushed rock	1,551	267	All to Netherlands Antilles.
Sand other than metal-bearing	792	--	
Other: Crude	4	--	
MINERAL FUELS AND RELATED MATERIALS			
Coal: Lignite including briquets	14	--	
Petroleum refinery products:			
Liquefied petroleum gas 42-gallon barrels	35	35	Mainly to St. Lucia.
Gasoline, motor do	9	1,785	France 1,768; Dominica 9; St. Lucia 8.
Kerosene and jet fuel do	28,977	109	All to France.
Distillate fuel oil do	--	2,499	Do.
Lubricants do	77	63	Martinique 28; French Guiana 21.
Bitumen and other residues do	--	12	All to Martinique.

[1]Table prepared by H. D. Willis. Guadeloupe did not report any exports of mineral commodities to the United States during 1986.
[2]Less than 1/2 unit.

Table 8.—Guadeloupe: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides value, thousands	$3	$3	--	All from France.
Metal including alloys, semimanufactures	482	480	87	France 365; Italy 17.
Chromium: Oxides and hydroxides	1	4	--	All from France.
Copper: Metal including alloys:				
Unwrought	--	1	--	Do.
Semimanufactures	148	165	3	France 159; Finland 1.

See footnotes at end of table.

Table 8.—Guadeloupe: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel: Metal:				
Pig iron, cast iron, related materials	1	21	--	All from France.
Ferroalloys	--	1	--	Do.
Semimanufactures:				
Bars, rods, angles, shapes, sections	13,720	16,111	--	Belgium-Luxembourg 8,060; France 4,504; West Germany 2,207.
Universals, plates, sheets	7,118	11,573	--	France 5,602; Martinique 5,319; Belgium-Luxembourg 652.
Hoop and strip	7	7	--	France 5; Belgium-Luxembourg 2.
Rails and accessories	7	--		
Wire	1,389	993	--	France 842; Belgium-Luxembourg 150; Italy 1.
Tubes, pipes, fittings	13,178	9,450	(2)	France 8,740; Spain 611; Belgium-Luxembourg 61.
Castings and forgings, rough	153	146	--	All from France.
Lead:				
Oxides	1	--		
Metal including alloys, semimanufactures	16	18	--	Do.
Mercury value, thousands	$1	$2	--	Do.
Nickel: Metal including alloys, semimanufactures	1	2	--	Mainly from France.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, platinum value, thousands	$5	$3	--	All from France.
Silver:				
Waste and sweepings[3] kilograms	1	--		
Metal including alloys, unwrought and partly wrought value, thousands	$1	--		
Tin: Metal including alloys, semimanufactures	1	1	--	Do.
Titanium: Oxides	19	10	--	Do.
Zinc:				
Oxides	--	1	--	Do.
Metal including alloys, semimanufactures	1	1	--	Do.
Other: Ashes and residues	166	110	--	Do.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc value, thousands	$11	$3	--	Do.
Grinding and polishing wheels and stones	12	18	--	France 11; Switzerland 6; Italy 1.
Asbestos, crude	154	132	--	All from France.
Barite and witherite	14	10	--	Do.
Boron materials: Crude natural borates	--	2	--	Do.
Cement	149,817	137,828	--	France 63,058; Venezuela 43,800; Spain 30,750.
Chalk	580	557	--	All from France.
Clays, crude	81	109	--	United Kingdom 60; France 49.
Diamond: Gem, not set or strung value, thousands	$1	--		
Diatomite and other infusorial earth	36	45	--	All from France.
Fertilizer materials:				
Crude, n.e.s	145	4	--	Do.
Manufactured:				
Ammonia	92	95	--	France 93; Italy 2.
Nitrogenous	2,353	2,600	390	Netherlands 1,921; France 239.
Phosphatic	210	99	--	All from France.
Potassic	120	370	350	Martinique 20.
Unspecified and mixed	19,375	18,819	31	Martinique 10,544; Netherlands 5,430; Belgium-Luxembourg 2,308.
Gypsum and plaster	9,967	10,690	--	Morocco 10,500; France 190.
Lime	549	621	--	France 561; Martinique 60.
Magnesium compounds: Magnesite, crude	126	126	--	All from Netherlands.
Mica:				
Crude including splittings and waste	19	15	--	All from France.
Worked including agglomerated splittings	--	6	--	Do.
Pigments, mineral: Iron oxides and hydroxides, processed	15	20	--	France 15; West Germany 5.

See footnotes at end of table.

Table 8.—Guadeloupe: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Precious and semiprecious stones other than diamond, natural value, thousands	$3	$19	--	All from France.
Salt and brine	2,451	2,294	--	France 1,184; Netherlands 508; West Germany 279.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	1	21	--	All from France.
Sulfate, manufactured	50	49	--	France 39; Netherlands 10.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	1	--		
Worked	135	119	--	Italy 61; France 45; Spain 13.
Dolomite, chiefly refractory-grade	499	460	--	All from France.
Gravel and crushed rock	930	709	--	Barbados 520; France 189.
Quartz and quartzite value, thousands	--	$1	--	All from France.
Sand other than metal-bearing	296	1,591	--	Suriname 700; Barbados 599; France 292.
Sulfur:				
Elemental, crude including native and byproduct	1	1	--	All from France.
Sulfuric acid	135	157	--	France 155; West Germany 2.
Talc, steatite, soapstone, pyrophyllite	46	102	--	All from France.
Other:				
Crude	131	145	--	France 129; West Germany 16.
Slag and dross, not metal-bearing	47	124	--	All from France.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1	--		
Carbon black	9	10	--	Do.
Coke and semicoke value, thousands	$2	--		
Peat including briquets and litter	NA	31	--	West Germany 20; France 11.
Petroleum:				
Crude value, thousands	--	$1	--	All from France.
Refinery products:				
Liquefied petroleum gas 42-gallon barrels	141,949	164,001	15,985	Netherlands Antilles 57,594; Martinique 41,795.
Gasoline, motor do.	808,087	464,559	--	Netherlands Antilles 239,326; Martinique 164,526; Trinidad and Tobago 58,812.
Mineral jelly and wax do.	401	1,133	--	France 1,086; Belgium-Luxembourg 47.
Kerosene and jet fuel do.	575,244	334,699	--	Netherlands Antilles 207,553; Martinique 46,237; Venezuela 40,835.
Distillate fuel oil do.	528,474	258,690	--	Martinique 198,399; Netherlands Antilles 30,765; Trinidad and Tobago 29,034.
Lubricants do.	36,708	34,790	105	France 27,160; Belgium-Luxembourg 3,780; Jamaica 2,268.
Residual fuel oil do.	404,295	595,351	--	Martinique 575,391; France 19,953.
Bitumen and other residues do.	43,838	39,614	--	Trinidad and Tobago 18,701; Venezuela 12,690; Netherlands Antilles 7,696.
Bituminous mixtures do.	479	200	--	Mainly from France.

NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]May include other precious metals.

Table 9.—Martinique: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Scrap	42	44	30	France 14.
Semimanufactures	2	1	--	All to Guadeloupe.
Copper: Metal including alloys:				
Scrap	447	404	--	All to France.
Semimanufactures	--	3	--	St. Vincent and Grenadines 2; France 1.
Iron and steel: Metal: Semimanufactures:				
Bars, rods, angles, shapes, sections	429	576	--	Guadeloupe 421; Netherlands Antilles 130; Franch Guiana 25.
Universals, plates, sheets	1,103	1,242	--	Guadeloupe 1,000; Trinidad and Tobago 145; French Guiana 25.
Hoop and strip	1	--		
Wire	5	--		
Tubes, pipes, fittings	12	15	--	Netherlands Antilles 12; France 2; Guadeloupe 1.
Lead: Metal including alloys, scrap	17	--		
INDUSTRIAL MINERALS				
Cement	19,383	19,557	--	French Guiana 18,951; Guadeloupe 580; Netherlands Antilles 14.
Chalk	80	--		
Clays, crude	11	--		
Fertilizer materials:				
Crude, n.e.s	--	5	--	All to St. Lucia.
Manufactured:				
Nitrogenous	6,413	2,502	--	St. Lucia 1,374; Guadeloupe 796; Guyana 200.
Potassic	391	800	--	Trinidad and Tobago 478; Guadeloupe 320; St Lucia 2.
Unspecified and mixed	31,715	15,845	--	Guadeloupe 8,811; St. Lucia 5,980; French Guiana 604.
Lime	58	444	--	French Guiana 384; Guadeloupe 60.
Magnesium compounds: Magnesite, crude	1	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	10	--		
Worked	3	--		
Dolomite, chiefly refractory-grade	16	--		
Gravel and crushed rock				
value, thousands	--	$2	--	All to France.
Sand other than metal-bearing	--	146	--	Mainly to St. Lucia.
Sulfur:				
Elemental, crude including native and byproduct	1	1	--	All to French Guiana.
Sulfuric acid	--	1	--	All to St. Lucia.
Other: Slag and dross, not metal-bearing	5	--		
MINERAL FUELS AND RELATED MATERALS				
Petroleum refinery products				
Liquefied petroleum gas				
42-gallon barrels	38,350	31,668	--	Mainly to Guadeloupe.
Gasoline, motor ---do---	151,368	180,923	--	All to Guadeloupe.
Kerosene and jet fuel ---do---	70,393	51,290	--	Do.
Distillate fuel oil ---do---	179,174	334,462	--	Do.
Lubricants ---do---	21	77	--	Guadeloupe 70; French Guiana 7.
Residual fuel oil ---do---	165,727	590,502	--	All to Guadeloupe.
Bitumen and other residues ---do---	6	--		

[1]Table prepared by H. D. Willis.

Table 10.—Martinique: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides value, thousands	$2	$1	--	All from France.
Metal including alloys, semimanufactures	193	459	231	France 220; Italy 2.
Chromium: Oxides and hydroxides	1	--		
Cobalt: Oxides and hydroxides value, thousands	$1	$1	--	All from France.
Columbium and tantalum: Metal including alloys, all forms, tantalum do.	--	$10	--	Do.
Copper: Metal including alloys:				
Unwrought do.	$2	--		
Semimanufactures	108	135	3	France 127; Austria 5.
Iron and steel: Metal:				
Scrap value, thousands	--	$1	--	All from France.
Pig iron, cast iron, related materials	--	3	--	Do.
Steel, primary forms value, thousands	$1	--		
Semimanufactures:				
Bars, rods, angles, shapes, sections	16,938	16,947	4	Trinidad and Tobago 6,181; Belgium-Luxembourg 5,057; France 3,834.
Universals, plates, sheets	7,898	7,304	--	France 6,959; Belgium-Luxembourg 278; West Germany 34.
Hoop and strip	5	3	--	All from France.
Rails and accessories	4	1	--	Do.
Wire	256	188	(2)	France 131; Belgium-Luxembourg 57.
Tubes, pipes, fittings	4,882	3,463	2	France 2,397; Spain 767; Italy 268.
Castings and forgings, rough	262	199	--	France 182; Belgium-Luxembourg 17.
Lead:				
Oxides	5	--		
Metal including alloys, semimanufactures	3	3	--	All from France.
Nickel: Metal including alloys:				
Unwrought value, thousands	$2	$1	--	All from West Germany.
Semimanufactures	1	1	--	All from France.
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$1	--		
Tin: Metal including alloys:				
Unwrought	$5	--		
Semimanufactures	1	1	--	All from France.
Titanium: Oxides	191	244	--	United Kingdom 166; France 78.
Zinc:				
Oxides	18	17	--	All from France.
Metal including alloys:				
Unwrought	1	--		
Semimanufactures	2	7	--	Do.
Other:				
Ashes and residues	169	285	--	Do.
Base metals including alloys, all forms value, thousands	$1	--		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	5	8	--	Do.
Artificial: Corundum	2	1	--	Do.
Grinding and polishing wheels and stones	34	27	(2)	France 20; Italy 6.
Asbestos, crude	61	107	--	All from Italy.
Barite and witherite	2	--		
Boron materials:				
Crude natural borates	161	20	--	Turkey 16; France 4.
Oxides and acids value, thousands	--	$1	--	All from France.
Cement	129,518	134,545	--	France 66,575; Venezuela 52,970; Spain 15,000.
Chalk	573	672	--	All from France.
Clays, crude	75	392	--	France 379; United Kingdom 13.
Diamond: Gem, not set or strung value, thousands	$13	$2	--	All from France.
Diatomite and other infusorial earth	9	17	--	Do.

See footnotes at end of table.

Table 10.—Martinique: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Fertilizer materials:				
Crude, n.e.s	109	281	--	All from France.
Manufactured:				
Ammonia	82	72	--	Guadeloupe 60; France 12.
Nitrogenous	19,551	12,718	3,600	Netherlands 5,758; East Germany 2,497.
Phosphatic	72	118	--	France 108; Belgium-Luxembourg 10.
Potassic	19,854	20,033	9,372	East Germany 10,090; Belgium-Luxembourg 496.
Unspecified and mixed	20,807	31,790	708	Norway 21,328; Belgium-Luxembourg 6,006; France 2,866.
Graphite, natural	--	1	--	All from France.
Gypsum and plaster	8,257	9,749	--	Morocco 9,500; France 236; Spain 13.
Lime	205	201	--	All from France.
Magnesium compounds: Magnesite, crude	399	342	--	All from Greece.
Mica: Worked including agglomerated splittings	6	--		
Nitrates, crude	--	7	--	All from France.
Pigments, mineral: Iron oxides and hydroxides, processed	10	23	--	France 18; West Germany 5.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$16	$16	--	All from France.
Synthetic do	--	$3	--	Do.
Salt and brine	2,373	2,532	--	West Germany 1,408; France 727; United Kingdom 317.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	34	13	--	All from France.
Sulfate, manufactured	203	305	--	Do.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	2	17	--	Do.
Worked	172	204	--	Italy 122; France 64; Portugal 12.
Dolomite, chiefly refractory-grade	1,260	680	--	All from France.
Gravel and crushed rock	4	5	--	Do.
Quartz and quartzite	1	8	--	Do.
Sand other than metal-bearing	38	29	--	Do.
Sulfur:				
Elemental:				
Crude including native and by-product	14	3	--	Do.
Colloidal, precipitated, sublimed	13	5	--	All from United Kingdom.
Sulffuric acid	219	251	--	France 199; West Germany 21; Netherlands 21.
Talc, steatite, soapstone, pyrophyllite	31	46	--	All from France.
Other:				
Crude	368	146	--	France 100; Belgium-Luxembourg 46.
Slag and dross, not metal-bearing	378	120	--	All from France.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	6	60	--	Mainly from France.
Carbon black	--	1	--	All from France.
Coal: Briquets of anthracite and bituminous coal	5	--		
Coke and semicoke	--	1	--	Do.
Peat including briquets and litter	18	37	--	Mainly from West Germany.
Petroleum:				
Crude thousand 42-gallon barrels	1,817	3,005	--	United Kingdom 2,371; United Arab Emirates 634.
Refinery products:				
Liquefied petroleum gas 42-gallon barrels	12,690	31,912	--	Venezuela 14,604; United Kingdom 7,076; Trinidad and Tobago 6,531.
Gasoline, motor do	55,403	38,514	--	Netherlands Antilles 24,684; France 13,830.
Mineral jelly and wax do	3,069	2,337	--	All from France.
Kerosene and jet fuel do	79,135	47,903	--	Netherlands Antilles 28,621; Trinidad and Tobago 19,282.
Distillate fuel oil do	25,274	3,760	--	All from Trinidad and Tobago.
Lubricants do	1,437,268	342,034	336	Venezuela 313,054; France 20,748; Belgium-Luxembourg 5,082.
Bitumen and other residues do	40,135	37,693	--	Trinidad and Tobago 15,077; Netherlands Antilles 11,223; Venezuela 10,490.
Bituminous mixtures do	964	255	24	France 224; Italy 6.

[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.

HAITI[10]

The three-member provisional Government Conseil National de Gouvernement (CNG), established in February 1986, was in place throughout 1987. The CNG announced its intention to have full democratic elections, and full civil liberties were instituted. A new Constitution was ratified in March 1987. However, because of demonstrations, political unrest, civil disorders, and violence, elections scheduled for November had to be postponed.

Haiti, with a variety of mineral resources, including bauxite, copper, gold, iron ore, silver, sulfur, and tin, continued to be underexplored and underdeveloped. During the current decade, the northern part of the country has been explored by international geologists, mining companies, and organizations. Reportedly, the Bureau des Mines et de l'Energie was negotiating with two U.S. companies, AMAX Inc. and Coca Mines Inc. as well as with a domestic company, Gedsa S.A., for the exploitation of the gold-silver deposit in the Grand Bois area, 200 miles north of Port-au-Prince. The ore body covers 10 hectares and is in excess of 20 meters thick. Preliminary ore reserves were estimated at 3.7 million tons with 2.6 grams of gold per ton and 13 grams of silver per ton.

In the Milot area, a gold-bearing ore was found in Morne Bossa. In 1987, 2 million tons of ore averaging 2.25 grams of gold per ton was identified. La Géominérale d'Haiti S.A. continued to study joint-venture proposals from foreign companies for gold exploration and exploitation in the recently studied areas with potential.

The Governments of Haiti and the Dominican Republic were carrying out geological investigations throughout the island of Hispaniola and formed working groups to plan new geological maps for the island. The areas of investigation in Haiti were the Massif de la Selle, Massif du Trou d'Eau, Plateau Central, and Massif du Nord. The areas of investigation in the Dominican Republic were Sierra del Bahoruco, Sierra de Neyba, Valle de San Juan, and the Cordillera Central.

Haiti was studying the possibility of increasing the development of its marble industry, mainly for export to the United States and Europe. Haiti has 22 open pit quarries. Further development of marble in Haiti appeared promising and could bring much needed foreign exchange to the country.

The Direction Promotion des Investissements (Prominex), the joint private-public sector entity funded by the U.S. Agency for International Development, continued to search for partners to develop the sea salt refinery at the mouth of Artibonite River. Production from the project would be for local consumption. The $200,000[11] project would refine salt through carbonization, filtration, and crystallization.

The United States continued to be Haiti's main trading partner. Haiti's goods also reached Belgium, Canada, France, the Federal Republic of Germany, Italy, and the Netherlands. Haiti's imports were mainly from the United States, followed by Canada and Japan.

JAMAICA[12]

Imports in 1987 increased significantly. The increase was attributed to strong economic growth caused by expanding construction, manufacturing, and tourism industries. The economy grew at about 5% relative to that of 1986. Exports also increased but at a lower rate than that of imports. The inflation rate was less than that of 1986 and the unemployment rate was estimated at 21%, the lowest in recent years. As of June, the national external debt was $3.64 billion.[13] During the year, the Government of Jamaica was able to reschedule payment of over $500 million of the total.

The International Monetary Fund (IMF) announced early in the year that it would provide a $51.5 million loan to Jamaica to compensate for weak earnings for alumina and bauxite exports during the fiscal year ending in September 1986. The loan from the IMF's Compensatory Financing Facility, to be paid back in 3 years, was part of the $159 million loan package of economic aid to Jamaica.

Production of bauxite increased in 1987 and Jamaica maintained its position as the third largest producer in the world after Australia and Guinea. Both alumina producers in Jamaica, the Aluminium Co. of Canada Ltd. (Alcan) and the Government-owned Clarendon Alumina Production Ltd.,

which was leasing the Alcoa refinery at Nain, increased production in 1987.

Alcan and Jamaica were unable to resolve the longstanding dispute over production levels of their jointly owned alumina refineries in Kirkvine and Ewarton; therefore, they agreed to have a British court settle the dispute through arbitration. The hearings began in November. One of the issues to be resolved was the Government's right to force Alcan, the majority partner, to increase its production to full capacity. Under the joint-venture company, Jamalcan, the Government only has a 7% stake in Alcan's mining and refining operations in Jamaica. Another issue to be resolved by arbitration was whether Alcan had to sell its excess output to the Government at its production cost.

Since 1986, the Government had been trying to negotiate with Alcan to increase its production of the two plants' combined 1.1-million-ton production capacity, offering to purchase any excess alumina produced at Government-determined prices (based on cost of production). Jamaica would then resell the alumina to its own markets developed worldwide. Alcan claimed that its refusal to enter into the agreement derived from its view that increased production would result in increases in production costs, that Jamaica's subsequent resale would increase Alcan's competition and depress alumina prices, and that the company had to reserve the right to fix the price at which to sell the excess alumina to Jamaica.

In December, the British court decided on the case. The court determined that the Government of Jamaica had no right under the 1978 joint-venture contractual agreement to require Alcan to increase its production to full capacity or to sell its excess production to the Government at production costs.

Alcoa, after leasing the Clarendon refinery to the Government of Jamaica in 1985, exercised its right in 1987 to resume operations by reactivating the joint-venture company Jamalco. Alcoa announced that it would resume full operational and commercial activities by February 1988. Alcoa, under the joint-venture agreement, owns 94% equity and the Government of Jamaica owns the remainder through Jamaica Bauxite Mining Ltd. Since March 1987, the Government had been negotiating with Alcoa to purchase the plant, but in September Alcoa decided not to sell.

Kaiser Jamaica Bauxite Co., the island's sole exporter of crude bauxite, obtained a contract during the year to supply 1 million tons to Reynolds Metals Co. of the United States. This stimulated an increase in bauxite production. However, the contract ended in December with no indication that it would be extended or renewed.

Jamaica, through Kaiser Jamaica, continued to supply 1 million tons of bauxite per year to the U.S.S.R. under a 7-year contract due to expire in 1990. However, reports indicated that the Government was interested in renegotiating the contract terms, including increasing exports to the Soviet Union to 1.5 million tons.

At yearend 1987, the Government canceled the 40-year bauxite mining lease of Alumina Partners of Jamaica (Alpart) signed in 1980. Alpart is owned by Kaiser Jamaica and Reynolds Metals (50% each). Alpart's 1.2-million-ton-per-year alumina plant was closed in August 1985 and remained closed throughout 1986 and 1987. Under the Mining Act, the Minister of Mining and Energy is given the authority to cancel a plant's lease if that plant is inactive for a period of 6 months.

Jamaica and Mexico were considering the feasibility of a joint venture to construct an aluminum facility based on Jamaican bauxite. A study group representing both countries was formed. The study's scope was to consider involvement of private companies from both countries and the terms of their participation in the joint venture. Later in the year, the Government of Jamaica announced that the project could be based on shared equity by both Governments and the private companies. The announcement indicated that bauxite would be mined and converted to alumina in Jamaica and later sent to Mexico for smelting into aluminum to take advantage of Mexico's abundant low-cost energy.

This was the second multinational aluminum related proposal. The first proposal involved a joint venture among Jamaica, Mexico, and Venezuela to build a 600,000-ton alumina refinery in Jamaica. The refinery was to be fueled with Mexican and Venezuelan oil, and the alumina was to be smelted into aluminum either in Mexico or Venezuela. In mid-1970, the plan was canceled.

In December 1987, the Governments of China and Jamaica signed a technical assistance agreement by which the two countries would share expertise in the mining of bauxite and the production of alumina.

According to reports, Chinese technicians would be trained at the Jamaica Bauxite Institute's pilot alumina plant while Jamaican officials, using Chinese technology, would attempt to recover rare chemicals from bauxite waste.

The Government, in conformance with its policy of reducing the state's involvement in the economy, continued its divestment program after privatizing the National Commercial Bank in December 1986. In June 1987, it sold its majority ownership of the Caribbean Cement Co., and 10% of the company was sold to Scandinavian Cement Co. (SCANCEM). Under the sales agreement SCANCEM, a joint venture between the Norwegian Cement Co. and the Euroc Group from Sweden, was also to provide technical assistance and exports for Caribbean Cement. During the year, Caribbean Cement was being expanded to double its production capacity to 800,000 tons per year, and its power supply was being converted from oil to coal.

Table 11.—Jamaica: Exports and reexports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate thousand tons	2,325	2,940	2,119	U.S.S.R. 821.
Oxides and hydroxides do.	1,620	1,580	169	Canada 642; Netherlands 308; United Kingdom 225.
Metal including alloys:				
Scrap	526	360	309	Netherlands 29; United Kingdom 18.
Unwrought	14	--	--	
Semimanufactures	354	234	6	Trinidad and Tobago 188; Dominica 13; Belize 11.
Copper: Metal including alloys:				
Scrap	354	269	137	West Germany 65; East Germany 59.
Semimanufactures value	$36	$276	--	All to Antigua and Barbuda.
Iron and steel: Metal:				
Scrap	1,544	291	165	Canada 126.
Pig iron, cast iron, related materials	--	25	--	All to Turks and Caicos Islands.
Semimanufactures:				
Bars, rods, angles, shapes, sections	20	89	(2)	Cayman Islands 86; Turks and Caicos Islands 3.
Universals, plates, sheets	1,250	3,094	280	Trinidad and Tobago 2,349; St. Lucia 201.
Wire	13	--	--	
Tubes, pipes, fittings	155	3	--	All to St. Vincent and the Grenadines.
Silver: Metal including alloys, unwrought and partly wrought value	--	$256	$256	
Tin: Metal including alloys:				
Scrap	608	406	406	
Semimanufactures	22	--	--	
Titanium: Oxides	--	11	--	Trinidad and Tobago 10; Haiti 1.
Zinc: Metal including alloys:				
Scrap	16	--	--	
Semimanufactures kilograms	--	210	--	NA.
Other:				
Oxides and hydroxides do.	--	300	--	All to Trinidad and Tobago.
Ashes and residues	--	73	73	
Base metals including alloys, all forms	--	79	68	West Germany 11.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones kilograms	--	15	--	All to Cayman Islands.
Cement	3,021	4,248	41	Haiti 1,783; Turks and Caicos Islands 1,353; Barbados 1,071.
Chalk	1	5	--	All to St. Lucia.
Fertilizer materials:				
Crude, n.e.s	38	--		
Manufactured:				
Ammonia	2	1	--	NA.
Unspecified and mixed	--	38	--	All to Cayman Islands.
Gypsum and plaster	160,548	100,143	29,722	Trinidad and Tobago 20,276; Panama 16,924.
Lime	89	36	18	Barbados 18.
Salt and brine	1,925	1,669	94	Trinidad and Tobago 693; Barbados 341; St. Lucia 158.
Sodium compounds, n.e.s.: Carbonate, manufactured kilograms	113	--		

See footnotes at end of table.

Table 11.—Jamaica: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone, crude and partly worked	5	10	--	All to St. Lucia.
Gravel and crushed rock	33	--		
Limestone other than dimension	18	151,912	151,822	NA.
Sand other than metal-bearing	10	--		
Sulfuric acid	38	159	38	Trinidad and Tobago 83; Haiti 38.
Talc, steatite, soapstone, pyrophyllite value	$705	--		
Other: Crude	--	36	--	All to Cayman Islands.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	75	--		
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	1,052	562	--	NA.
Gasoline do	52,488	28,996	--	Bahamas 14,316; Netherlands Antilles 10,076.
Mineral jelly and wax do	8	636	633	Belize 2.
Kerosene and jet fuel do	78,384	2,887	25	Netherlands Antilles 1,906; Bahamas 956.
Distillate fuel oil do	126,897	64,710	9,535	Bahamas 34,607; Netherlands Antilles 13,630.
Lubricants do	92,715	106,115	1,253	Guyana 24,616; El Salvador 16,332; Guatemala 14,152.
Residual fuel oil do	245,919	466,289	459,540	Haiti 5,447.
Bitumen and other residues do	376	--		

NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.

Table 12.—Jamaica: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate value	$468	--		
Oxides and hydroxides	10	1	1	
Metal including alloys:				
Unwrought	860	1,294	175	Canada 955; United Kingdom 100.
Semimanufactures	1,377	893	298	Canada 223; United Kingdom 185.
Chromium: Ore and concentrate	--	18	18	
Copper:				
Sulfate	6	1	(2)	Mainly from Netherlands.
Metal including alloys:				
Unwrought	1	1	(2)	Mainly from Canada.
Semimanufactures	618	615	217	United Kingdom 295; Australia 52.
Gold:				
Waste and sweepings value	$678	$184	--	All from Canada.
Metal including alloys, unwrought and partly wrought troy ounces	1,029	1,672	418	Canada 740; United Kingdom 514.
Iron and steel:				
Iron ore and concentrate including roasted pyrite	19	14	14	
Metal:				
Scrap value	$894	$28,371	--	All from New Zealand.
Pig iron, cast iron, related materials	283	3	3	
Ferroalloys:				
Ferrosilicon	24	23	23	
Unspecified value	--	$1,130	$1,130	
Steel, primary forms	5,666	3,519	132	Trinidad and Tobago 3,037; United Kingdom 190.

See footnotes at end of table.

Table 12.—Jamaica: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections	10,645	14,942	663	Trinidad and Tobago 10,727; Taiwan 1,700; United Kingdom 830.
Universals, plates, sheets	13,643	17,744	871	Japan 4,847; United Kingdom 4,406; Venezuela 3,614.
Hoop and strip	286	504	66	Japan 427; Belgium-Luxembourg 6.
Rails and accessories	331	14	--	All from Barbados.
Wire	r2,771	2,636	493	United Kingdom 468; Belgium-Luxembourg 411.
Tubes, pipes, fittings	3,021	3,608	2,145	West Germany 761; United Kingdom 307.
Castings and forgings, rough	30	21	17	Canada 4.
Unspecified	2	27	20	United Kingdom 5; Canada 2.
Lead:				
Oxides	251	207	178	United Kingdom 18; Netherlands 6.
Metal including alloys:				
Scrap	2	20	--	All from Trinidad and Tobago.
Unwrought	6	286	108	Trinidad and Tobago 178.
Semimanufactures	26	62	51	United Kingdom 9; Switzerland 2.
Magnesium: Metal including alloys:				
Unwrought value	$36	--	--	
Semimanufactures do	r$1,315	$1,408	$1,408	
Manganese: Ore and concentrate	193	53	--	United Kingdom 19; Belgium-Luxembourg 17; West Germany 17.
Molybdenum: Metal including alloys:				
Unwrought kilograms	443	10	10	
Semimanufactures	(2)	17	--	All from Taiwan.
Nickel: Metal including alloys, semimanufactures	2	3	(2)	West Germany 2; Canada 1.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value	$10,296	$1,380	$1,202	United Kingdom $178.
Silver:				
Waste and sweepings do	$172	$3,240	--	All from France.
Metal including alloys, unwrought and partly wrought troy ounces	32,215	31,508	5,819	United Kingdom 9,806; Canada 7,941; West Germany 7,941.
Tin: Metal including alloys:				
Scrap value	--	$2,400	$2,400	
Unwrought	--	1	1	
Semimanufactures	8,228	3,885	(2)	Netherlands 3,231; United Kingdom 654.
Titanium: Oxides	605	682	455	United Kingdom 209; Canada 18.
Tungsten:				
Ore and concentrate value	$517	--		
Metal including alloys, semimanufactures kilograms	117	70	70	
Uranium and thorium: Metal including alloys, all forms do	578	1,302	1,302	
Zinc:				
Ore and concentrate	--	2	--	All from Canada.
Oxides	95	151	77	Netherlands 53; United Kingdom 21.
Blue powder	16	1	--	All from Trinidad and Tobago.
Metal including alloys:				
Unwrought	548	629	429	France 100; Canada 98.
Semimanufactures	15	2	1	United Kingdom 1.
Other:				
Ores and concentrates	3	3	--	All from United Kingdom.
Oxides and hydroxides	122	229	86	Japan 66; United Kingdom 59.
Ashes and residues value	--	$13	--	All from United Kingdom.
Base metals including alloys, all forms kilograms	6	60	60	

See footnotes at end of table.

Table 12.—Jamaica: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	24	23	22	United Kingdom 1.
Dust and powder of precious and semiprecious stones excluding diamond value	--	$644	--	All from United Kingdom.
Grinding and polishing wheels and stones	26	152	3	Spain 142; United Kingdom 3.
Asbestos, crude	3	31	28	United Kingdom 3.
Barite and witherite value	$2,983	$5	$5	
Boron materials: Crude natural borates do	$286	--		
Cement	2,374	16,003	82	Barbados 14,304; Trinidad and Tobago 1,200; Colombia 125.
Chalk	6	13	--	All from United Kingdom.
Clays, crude	332	384	380	United Kingdom 4.
Diamond: Industrial stones value	--	$3,762	--	All from United Kingdom.
Diatomite and other infusorial earth	27	104	104	
Feldspar, fluorspar, related materials	9	13	13	
Fertilizer materials:				
Crude, n.e.s	65	465	415	Dominican Republic 50.
Manufactured:				
Ammonia	157	148	51	Japan 89; United Kingdom 8.
Nitrogenous	17,023	21,842	637	Canada 21,151; West Germany 50.
Phosphatic	890	312	309	West Germany 3.
Potassic	183	3,096	182	Canada 2,914.
Unspecified and mixed	6,393	11,892	2,292	Canada 9,550; Dominican Republic 50.
Graphite, natural value	$2	$2,248	$2,054	United Kingdom $194.
Gypsum and plaster	51	62	62	
Lime value	$138	$956	$956	
Magnesium compounds:				
Magnesite, crude	(3)	--		
Oxides and hydroxides value	--	$14	--	All from United Kingdom.
Other	70	17	8	United Kingdom 9.
Mica:				
Crude including splittings and waste	119	103	3	Norway 77; Netherlands 23.
Worked including agglomerated splittings kilograms	9,501	180	180	
Nitrates, crude value	$7,531	$258	$258	
Phosphates, crude	114	283	283	
Pigments, mineral:				
Natural, crude	21	24	(2)	Mainly from West Germany.
Iron oxides and hydroxides, processed	53	27	6	West Germany 7; United Kingdom 5.
Precious and semiprecious stones other than diamond, synthetic value	$246	--		
Salt and brine	25,058	20,542	20,395	United Kingdom 90; Canada 57.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	4,244	6,016	5,675	France 279; Netherlands 21.
Sulfate, manufactured	r1,103	970	63	Mexico 500; Belgium-Luxembourg 361.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	116	124	4	Italy 100; West Germany 20.
Worked	11	3	3	
Dolomite, chiefly refractory-grade	14	--		
Gravel and crushed rock	435	23	18	United Kingdom 5.
Limestone other than dimension value	$148	$604	$604	
Quartz and quartzite	15	26	1	Italy 25.
Sand other than metal-bearing	910	20	20	
Sulfur:				
Elemental:				
Crude including native and byproduct	28	68	48	Belgium-Luxembourg 20.
Colloidal, precipitated, sublimed	2,947	302	301	West Germany 1.
Dioxide	1	--		
Sulfuric acid	1,592	4	4	
Talc, steatite, soapstone, pyrophyllite	463	1,170	1,099	Norway 46; Netherlands 23.
Other:				
Crude	26	14	(2)	Mainly from Canada.
Slag and dross, not metal-bearing	2	--		

See footnotes at end of table.

Table 12.—Jamaica: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	18	736	72	Venezuela 664.
Carbon black	952	740	35	Venezuela 687; Singapore 18.
Coal:				
Anthracite—value	$776	$810	$810	
All grades including briquets	--	5,090	--	All from West Germany.
Coke and semicoke	r102	55	38	West Germany 10; United Kingdom 7.
Peat including briquets and litter	45	22	22	
Petroleum:				
Crude—42-gallon barrels	63	31	31	
Refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	522	601	458	Venezuela 132; Mexico 11.
Gasoline—do	587	788	65	Venezuela 431; Trinidad and Tobago 183; Netherlands Antilles 80.
Mineral jelly and wax—do	10	14	9	United Kingdom 3; West Germany 1.
Kerosene and jet fuel—do	328	607	50	Venezuela 360; Netherlands Antilles 138; Trinidad and Tobago 59.
Distillate fuel oil—do	286	399	144	Netherlands Antilles 120; Venezuela 119.
Lubricants—do	55	27	15	France 10; United Kingdom 1.
Residual fuel oil—do	11,347	20,689	2,943	Netherlands Antilles 10,070; Venezuela 4,227.
Bitumen and other residues do	1	137	(2)	Venezuela 62; Trinidad and Tobago 41; Netherlands Antilles 33.
Bituminous mixtures—do	1	1	1	
Petroleum coke—value	$261	$37	$37	

rRevised.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Revised to zero.

NETHERLANDS ANTILLES[14]

Petróleos de Venezuela S.A. (PDVSA) was planning to invest in its subsidiary, Refinería Isla de Curazao S.A. on the island of Curaçao. Before making the investment, PDVSA wanted a 10-year lease to guarantee return on the refinery. The 320,000-barrel-per-day refinery has been leased to PDVSA since 1985. The company had been producing at about 50% capacity in 1986 but planned to increase production to 185,000 barrels per day in 1987. Imports of crude oil from countries other than Venezuela would cover requirements that exceeded the Organization of Petroleum Exporting Countries (OPEC) quotas. After the company imported 150,000 barrels of crude from countries other than Venezuela, the rising spot prices forced PDVSA to decrease production at the Curaçao refinery by 50,000 barrels per day.

During a visit to the Netherlands Antilles that ended in November, the President of Venezuela signed a protocol that extended PDVSA's lease of the Curaçao refinery for 4 years. The lease will expire on September 30, 1994, and the lease payment was increased from $11 to $15 million per year.[15] Products from this refinery are exported mainly to the United States and to Caribbean countries.

TRINIDAD AND TOBAGO[16]

Trinidad and Tobago's economy declined by almost 7% in 1987. The construction and petroleum industries were the main sectors of the economy that contributed to the decline. Trinidad and Tobago, in a recession since 1982, continued to depend heavily on oil for its export revenues in 1987. However, efforts were being made to increase the export share of products other than oil, which in the first 4 months of 1987 was

more than three times that of 1985 and 17% higher than that of 1986. To avoid further contraction of its economy because of depressed oil prices and to address some of the country's economic problems, the Government was planning new development policies, which included divestment of Government-owned enterprises, better marketing of tourism, a more liberal foreign investment law, and national tax reform.

In agreement with the plans to attract more foreign investment to the country, the Government approved a new foreign investment policy. The policy created a "one-stop" investment office at the Trinidad and Tobago Industrial Development Corp. to reduce investors' processing time. The incentives for investors under the new policy include tax concessions, grants for research and development, special benefits for those businesses that would be in rural areas, and allowances for foreign investors to own up to 20% of local company shares without obtaining an alien landholding license. In select cases, the investor may have 100% ownership with the requirement to contribute 100% of foreign capital and 75% of technology. The areas in which the Government has established priorities include asphalt, chemicals, plastics, and downstream steel products.

On June 13, 1987, the 12% stamp duty on imports from some Caribbean Community and Common Market (CARICOM) countries was temporarily removed for a period of 12 months. Trinidad and Tobago would only remove the duty on those countries that exempt CARICOM products from similar taxes. The Government also expressed its intention to look into its import license system, considered to be a form of import control.

Reports indicated that the Government was trying to restructure and privatize the Iron and Steel Co. of Trinidad and Tobago (ISCOTT), which has continuously lost money since it began operation in 1981. In 1987, the International Finance Corp. (IFC), an affiliate of the International Bank for Reconstruction and Development (World Bank), was asked by the Prime Minister to study the privatization of ISCOTT and to assist the Government in the negotiations with potential buyers. Neue Hamburger Stahlwerke (Hamburger) of the Federal Republic of Germany and Voest-Alpine AG of Austria, ISCOTT's managers since 1986, were among the potential buyers. Several U.S. companies and a domestic company, Central Trinidad Steel Ltd., were also interested in the mill.

The recommendation by IFC specified that the Government should assume responsibility for ISCOTT's debt, spend $28 million[17] in upgrading the facility, and lease it to Hamburger for 10 years. Hamburger should then set up a steelworks centered around ISCOTT.

After years of complaints of dumping and unfair market practices by U.S. steel producers, Trinidad and Tobago agreed to limit its steel exports to the United States. In response to the voluntary quota, the United States agreed to lift a 16.4% tariff it had imposed on steel products from Trinidad and Tobago in 1984. The quota, 73,500 tons of steel per year to the United States, was to be retroactive to October 1, 1984, and limits Trinidad and Tobago's annual exports to the United States to 40,000 tons of wire rods, 3,500 tons of billets, and 30,000 tons of other steel products. The United States in turn was to reimburse the duties paid since that date. The agreement will remain in effect until September 30, 1989.

Five U.S. producers filed an initial complaint with the U.S. Government in 1983. The producers charged that ISCOTT was being subsidized by the Government and that ISCOTT was dumping its output in the United States. The 16.4% antidumping and countervailing duty was imposed after an investigation was conducted by the U.S. Department of Commerce and the U.S. International Trade Commission. The 1987 voluntary quota represents less than 10% of ISCOTT's production capacity.

Trinscat Ltd., the first plant opened under the U.S. Caribbean Basin Initiative, was formally opened in 1987. The company, owned 60% by the United States-based company Castech Inc. and 40% by Trinidad and Tobago's Neal and Massy Co. Inc., began production in July 1986 and produces about 4,100 tons of bronze castings. Trinscat products replaced items that were previously imported from the Republic of South Africa. The company has a capacity of earning as much as $ 4.1 million of foreign exchange per year.

Trinidad and Tobago continued to be among the leading exporters of nitrogenous fertilizers in the world. Production in 1987 remained at about the same level of that of 1986. In 1987, the Government announced plans to build a major fertilizer complex adjacent to its urea plant in Point Lisas. The project, a 1,500-ton-per-day anhydrous ammonia plant would provide continuous

feedstock to the urea plant; would increase the country's consumption of its natural gas output; and would be built with the assistance of Japan, Norway, and the United States. The joint venture among the Government of Trinidad and Tobago (51%), and M. W. Kellogg Co. of the United States and Norsk Hydro A/S of Norway (24.5% each) was being financed by Mitsubishi. M. W. Kellogg designed the plant and will provide the engineering, procurement, and construction services.

The Minister of Mines and Energy indicated that Trinidad and Tobago was seriously considering the possibility of joining or maintaining a specific link with OPEC.

The Cabinet approved a new energy policy draft aimed at optimizing offshore oil reserves, introducing production of low-octane gasoline, and increasing natural gas output.

Feasibility studies for Government and private exploitation of natural gas reserves off the southeastern coast of Trinidad were commissioned. The Government was accepting proposals from foreign investors, and two cabinet-appointed committees were considering former proposals for the development of South East Coast Consortium (SECC) and Amoco Trinidad Oil Co.'s gas exploration facilities expansion project. Later in the year, the committees recommended that SECC should initially carry out the project development off the southeastern coast of Trinidad with Amoco possibly doing some development later. Accordingly, the Government decided to continue with its plans of developing its own gas facilities. The Government also decided to ask Amoco to develop the facilities in the long term. Production from the $117 million natural gas platform was planned to be 65 million cubic feet per day. The startup date was planned for 1990. Reportedly, Amoco's involvement in the project would begin with the development of a second platform after the first platform had been in production for approximately 3 to 4 years and its production had begun to decline.

A pilot project initiated by the Government in 1986 to use natural gas as a fuel for motor vehicles, and was to involve 250 Government vehicles for 5 years, met with modest success but was still being pursued by Natural Gas System (NGS), a local company. During the first 12 months of the program, only 24 cars made the changeover from gasoline to natural gas. As a result, NGS registered significant losses. The cost of installing the natural gas tank was approximately $1,000 per car. During the year, only one supply station was available. The company had plans to open two additional stations in the near future.

The Government was considering a $200 million methanol plant at Point Fortin proposed by Union Carbide Corp. and Wimpney Ltd., a British firm.

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[1]Prepared by Ivette E. Torres, physical scientist, Division of International Minerals.
[2]Where necessary, values have been converted from Aruban florins (AF|$) to U.S. dollars at the rate of AF|$1.79=US$1.00.
[3]By Harold R. Newman, physical scientist, Division of International Minerals.
[4]By Harold R. Newman, physical scientist, Division of International Minerals.
[5]Where necessary, values have been converted from Barbadian dollars (Bds$) to U.S. dollars at the rate of Bds$2.0113=US$1.00.
[6]Prepared by Ivette E. Torres, physical scientist, Division of International Minerals.
[7]Where necessary, values have been converted from Cuban pesos (CP$) to U.S. dollars at the rate of CP$0.7=US$1.00.
[8]Prepared by Ivette E. Torres, physical scientist, Division of International Minerals.
[9]Where necessary, values have been converted from Dominican pesos (RD$) to U.S. dollars at the rate of RD$4.96=US$1.00.
[10]Prepared by Ivette E. Torres, physical scientist, Division of International Minerals.
[11]Where necessary, values have been converted from Haitian gourdes (HG$) to U.S. dollars at the rate of HG$5.0=US$1.00.
[12]Prepared by Ivette E. Torres, physical scientist, Division of International Minerals.
[13]Where necessary, values have been converted from Jamaican dollars (J$) to U.S. dollars at the rate of J$5.5=US$1.00.
[14]Prepared by Ivette E. Torres, physical scientist, Division of International Minerals.
[15]Where necessary, values have been converted from Netherlands Antillean guilders (NAE$) to U.S. dollars at the rate of NAE$1.8=US$1.00.
[16]Prepared by Ivette E. Torres, physical scientist, Division of International Minerals.
[17]Where necessary, values have been converted from Trinidadian and Tobagar dollars (TT$) to U.S. dollars at the rate of TT$3.6=US$1.00.

Table 13.—Trinidad and Tobago: Exports and reexports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides ____ kilograms__	400	--		
Metal including alloys:				
Scrap ____	72	24	--	All to Netherlands.
Unwrought____	--	25	--	All to Pakistan.
Semimanufactures ____	180	53	40	Grenada 8; Guyana 4.
Chromium: Oxides and hydroxides kilograms__	400	--		
Copper: Metal including alloys:				
Scrap____	875	691	49	West Germany 272; United Kingdom 258; Netherlands 94.
Unwrought ____	8	27	--	Mainly to United Kingdom.
Semimanufactures____	1	267	266	Barbados 1.
Iron and steel: Metal:				
Scrap____	120	87	14	United Kingdom 37; West Germany 36.
Pig iron, cast iron, related materials _	61,326	54,371	(2)	Venezuela 53,207; Barbados 1,160; Grenada 4.
Ferroalloys ____	28	--		
Steel, primary forms____	1,271	28,280	--	Italy 11,516; Ecuador 10,176; Dominican Republic 5,836.
Semimanufactures:				
Bars, rods, angles, shapes, sections	104,781	227,471	97,923	Canada 40,339; West Germany 16,531.
Universals, plates, sheets ____	63	539	116	United Kingdom 231; Martinique 86.
Hoop and strip____ value__	$678	$78	--	Barbados $50; St. Christopher and Nevis $28.
Rails and accessories ___do____	$541	$167	--	All to St. Vincent.
Wire____	58	161	4	St. Vincent 57; St. Lucia 51; Grenada 45.
Tubes, pipes, fittings ____	464	4,511	4,473	St. Vincent 8; Guyana 7.
Castings and forgings, rough ____ kilograms__	195	1,490	--	Grenada 840; Panama 500; Guyana 150.
Lead:				
Oxides ____	--	40	--	All to Barbados.
Metal including alloys:				
Unwrought____	153	210	--	Jamaica 188; Honduras 22.
Semimanufactures _ kilograms__	NA	601	--	St. Lucia 600; bunkers 1.
Nickel: Metal including alloys:				
Scrap____	--	75	--	Netherlands 50; West Germany 25.
Semimanufactures____ kilograms__	--	75	--	Grenada 25; Guyana 20; bunkers 30.
Platinum-group metals: Metals including alloys, unwrought and partly wrought troy ounces__	--	32	32	
Silver:				
Waste and sweepings[3] kilograms__	r135	218	200	Canada 18.
Metal including alloys, unwrought and partly wrought _ troy ounces__	1,608	2,958	--	All to Canada.
Tin: Metal including alloys:				
Scrap____	--	199	199	
Semimanufactures____ value__	--	$1,973	--	Jamaica $1,959; Grenada $14.
Titanium: Oxides____	--	2	--	All to Barbados.
Tungsten: Metal including alloys, unwrought kilograms__	--	116	--	Venezuela 96; Guyana 20.
Zinc: Metal including alloys, semimanufactures____ do____	--	100	--	All to Guyana.
Other:				
Oxides and hydroxides ____ do____	645	400	--	All to Barbados.
Base metals including alloys, all forms do____	110	--		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones ____ do____	606	234	7	Guyana 190; Grenada 30.
Barite and witherite ____ value__	--	$135	--	All to Barbados.
Cement____	6	9,632	--	Grenada 2,211; St. Vincent 1,329; St. Christopher and Nevis 1,300.
Chalk____	4	--		
Clays, crude ____	18	1,121	160	Barbados 961.

See footnotes at end of table.

Table 13.—Trinidad and Tobago: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Diamond:				
Gem, not set or strung ____ carats	2	--		
Industrial stones ____ value	$959	$2,897	NA	NA.
Fertilizer materials: Manufactured:				
Ammonia ____ thousand tons	1,157	1,121	525	Belgium-Luxembourg 169; Denmark 133.
Nitrogenous ____	361,627	506,894	169,350	France 79,669; Canada 68,962.
Phosphatic ____ value	$1,429	$97	--	All to Guyana.
Potassic ____ do____	--	$344	--	Grenada $263; Guyana $81.
Unspecified and mixed ____	--	8	--	Guyana 5; St. Lucia 3.
Gypsum and plaster ____ value	$245	$340	--	Guyana $173; St. Vincent $167.
Lime ____ do____	$440	$534	--	Grenada $294; St. Lucia $185; Dominica $55.
Mica:				
Crude including splittings and waste	3	--		
Worked including agglomerated splittings ____ kilograms	10	--		
Pyrite, unroasted ____ value	--	$33	--	All to Barbados.
Salt and brine ____	193	18	--	Grenada 6; St. Christopher and Nevis 4; St. Vincent 4.
Sodium compounds, n.e.s.:				
Carbonate, manufactured kilograms	545	3	--	All for bunkers.
Sulfate, manufactured ____ do____	140	20	--	All to Venezuela.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked value	$4	$639	--	Grenada $556; St. Vincent $83.
Worked ____ do____	--	$316	$28	Grenada $288.
Gravel and crushed rock ____	2	32	--	Anguilla 25; Grenada 7.
Limestone other than dimension ____	--	13	--	All to Guyana.
Sand other than metal-bearing ____	20	82	--	Grenada 62; Anguilla 20.
Sulfur: Sulfuric acid ____ kilograms	--	143	--	Dominica 140; Grenada 3.
Talc, steatite, soapstone, pyrophyllite value	$1,480	$411	--	All to Guyana.
Other: Crude ____	--	27	--	Barbados 14; Grenada 13.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural ____	31,786	30,512	311	West Germany 12,848; United Kingdom 3,746; Guadeloupe 3,114.
Coal: Briquets of anthracite and bituminous coal ____	--	60	--	All to Grenada.
Peat including briquets and litter ____	--	1	--	Mainly to Antigua.
Petroleum:				
Crude thousand 42-gallon barrels	35,300	32,867	32,867	
Refinery products:				
Liquefied petroleum gas do____	262	197	--	Barbados 41; Guyana 30; French Guiana 23.
Gasoline ____ do____	3,084	2,896	476	Japan 426; Suriname 373.
Mineral jelly and wax ____ do____	(2)	(2)	--	Mainly to Barbados.
Kerosene and jet fuel ____ do____	2,493	2,145	258	Barbados 486; Japan 281.
Distillate fuel oil ____ do____	4,090	3,955	1,317	Canada 419; Suriname 367.
Lubricants ____ do____	18	13	1	Dominica 3; St. Lucia 1; bunkers 4.
Residual fuel oil ____ do____	15,056	15,319	10,351	Italy 2,019; United Kingdom 1,114.
Bitumen and other residues do____	(2)	912	--	Grenada 731; Guyana 181.
Bituminous mixtures ____ do____	20	25	9	Netherlands Antilles 5; Grenada 4.
Unspecified ____ do____	(4)	--		

[r]Revised. NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]May include other precious metals.
[4]Revised to zero.

Table 14.—Trinidad and Tobago: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	315	450	450	
Oxides and hydroxides	43	29	2	United Kingdom 27.
Metal including alloys:				
Scrap	--	20	--	Mainly from Venezuela.
Unwrought	14	60	46	Canada 14.
Semimanufactures	11,160	1,714	1,135	United Kingdom 225; Jamaica 192.
Chromium: Ore and concentrate	4	3	--	All from Netherlands.
Copper:				
Ore and concentrate, value	--	$315	$315	
Matte and speiss including cement copper, do.	--	$222	--	All from Grenada.
Sulfate	15	5	(2)	Mainly from United Kingdom.
Metal including alloys:				
Scrap	1	120	117	Grenada 2; St. Vincent 1.
Unwrought	1	112	41	Chile 71.
Semimanufactures	1,058	797	70	United Kingdom 365; Canada 277.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	318,284	400,061	--	All from Brazil.
Metal:				
Scrap	5,261	2,200	--	All from Guyana.
Pig iron, cast iron, related materials	66	3	--	All from United Kingdom.
Ferroalloys:				
Ferromanganese	399	158	--	Norway 126; West Germany 32.
Ferrosilicon	454	1,225	252	Norway 837; United Kingdom 130.
Unspecified	1,602	1,060	50	Norway 810; United Kingdom 180.
Steel, primary forms	2,664	4,348	(2)	Japan 1,171; West Germany 1,066; Italy 881.
Semimanufactures:				
Bars, rods, angles, shapes, sections	13,639	69,466	34,544	United Kingdom 15,842; Japan 15,155.
Universals, plates, sheets	26,962	26,284	364	United Kingdom 4,369; Canada 2,539; Jamaica 2,328.
Hoop and strip	815	349	93	Japan 209; United Kingdom 47.
Rails and accessories	71	5	5	
Wire	3,226	2,489	207	Venezuela 842; Belgium-Luxembourg 739; United Kingdom 342.
Tubes, pipes, fittings	36,340	76,689	19,591	Taiwan 25,082; Argentina 7,913.
Castings and forgings, rough	(2)	6	6	
Lead:				
Oxides	5	25	1	United Kingdom 24.
Metal including alloys:				
Scrap	719	81	--	Barbados 80; Grenada 1.
Unwrought	22	(2)	(2)	
Semimanufactures	7	3	(2)	Mainly from United Kingdom.
Magnesium: Metal including alloys, all forms	3	4	3	United Kingdom 1.
Manganese: Ore and concentrate	1	4,040	500	Norway 2,000; West Germany 880.
Molybdenum: Metal including alloys, semimanufactures, kilograms	2	--		
Nickel:				
Matte and speiss, value	$970	--		
Metal including alloys, semimanufactures	6	1	(2)	Mainly from United Kingdom.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, value	$4,171	$10,431	$6,783	United Kingdom $3,145; Switzerland $503.
Silver:				
Waste and sweepings, kilograms	132	--		
Metal including alloys, unwrought and partly wrought, value	$94,297	$97,271	$22,433	Canada $73,907; Italy $931.
Tin: Metal including alloys:				
Unwrought	1	3	(2)	Mainly from United Kingdom.
Semimanufactures	15	65	(2)	Japan 57; United Kingdom 7.
Titanium: Oxides	1,315	1,043	295	United Kingdom 449; Finland 294.
Tungsten: Metal including alloys:				
Unwrought, kilograms	--	201	201	
Semimanufactures, do.	10	341	339	Switzerland 2.

See footnotes at end of table.

Table 14.—Trinidad and Tobago: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Zinc:				
Ore and concentrate	--	17	17	
Oxides	212	98	4	United Kingdom 82; Belgium-Luxembourg 5.
Blue powder	69	53	49	Norway 2; United Kingdom 1.
Metal including alloys:				
Scrap	43	49	--	All from Canada.
Unwrought	605	401	13	Canada 378; United Kingdom 10.
Semimanufactures	73	4,257	1	United Kingdom 4,256.
Other:				
Ores and concentrates	13	7,278	7,278	
Oxides and hydroxides	15	5	(2)	Italy 3; West Germany 1.
Base metals including alloys, all forms kilograms	8,699	2,734	2,561	West Germany 87; United Kingdom 83.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc value	$48,109	$2,549	$1,324	Colombia $1,190; United Kingdom $35.
Artificial: Silicon carbide	(3)	--		
Dust and powder of precious and semiprecious stones value	$122	$26	$26	
Grinding and polishing wheels and stones	1,104	3,523	3,453	Venezuela 36; United Kingdom 13.
Asbestos, crude	(2)	5	--	All from Netherlands.
Barite and witherite	19,809	19,081	--	Morocco 18,986; West Germany 88; Netherlands 7.
Boron materials: Crude natural borates	4	2	--	All from United Kingdom.
Cement	64,549	10,853	865	West Germany 5,294; Barbados 3,500.
Chalk	698	942	95	France 545; United Kingdom 302.
Clays, crude	2,402	3,742	3,487	United Kingdom 247; Canada 8.
Diamond:				
Gem, not set or strung carats	10,342	825	72	India 484; United Kingdom 206.
Industrial stones do	5,000	--		
Diatomite and other infusorial earth	9,082	75	39	Netherlands 29; United Kingdom 7.
Feldspar, fluorspar, related materials	106	107	--	Netherlands 60; United Kingdom 38; Canada 9.
Fertilizer materials:				
Crude, n.e.s	5	88	--	All from Netherlands.
Manufactured:				
Ammonia	5	17,508	17,501	Netherlands 6; West Germany 1.
Nitrogenous	2,990	1,782	184	Belgium-Luxembourg 632; Dominican Republic 422; Netherlands 250.
Phosphatic	6,338	2,327	1,136	Netherlands 1,178; Dominican Republic 7.
Potassic	669	3,125	1,661	Netherlands 614; Martinique 500.
Unspecified and mixed	5,310	13,022	9,231	West Germany 2,901; Netherlands 261.
Graphite, natural	(2)	2	2	
Gypsum and plaster	3,410	10,973	33	Jamaica 10,798; United Kingdom 85; West Germany 57.
Lime	4,200	4,210	--	United Kingdom 4,086; Canada 124.
Magnesium compounds: Magnesite, crude	(2)	4	(2)	Mainly from United Kingdom.
Mica:				
Crude including splittings and waste	117	129	--	United Kingdom 71; Norway 58.
Worked including agglomerated splittings kilograms	11	3	--	All from United Kingdom.
Phosphates, crude	236	168	68	United Kingdom 100.
Pigments, mineral: Iron oxides and hydroxides, processed	119	304	(2)	West Germany 215; Canada 40; Denmark 36.
Potassium salts, crude	--	82	--	Netherlands 80; Canada 2.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$882	$862	$7	Canada $442; Belgium-Luxembourg $357; India $56.
Synthetic do	$16	$44	$4	India $35; France $2.
Pyrite, unroasted	--	5	5	
Salt and brine	15,351	86,841	83	West Germany 63,001; Netherlands Antilles 19,403; United Kingdom 923.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	5,232	9,451	4,920	West Germany 2,417; France 2,000.
Sulfate, manufactured	2,604	2,438	89	Belgium-Luxembourg 2,248; West Germany 42.

See footnotes at end of table.

Table 14.—Trinidad and Tobago: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	179	94	40	China 34; West Germany 20.
Worked	205	35	4	Italy 21; Barbados 5.
Dolomite, chiefly refractory-grade	34	(2)	(2)	
Gravel and crushed rock	11,353	3,054	2,513	China 483; Venezuela 29.
Limestone other than dimension	14,779	11,586	1,632	Barbados 8,022; Netherlands Antilles 1,264.
Quartz and quartzite	2	36	--	United Kingdom 28; Netherlands 8.
Sand other than metal-bearing	7,256	715	702	United Kingdom 12; Japan 1.
Sulfur:				
Elemental:				
Crude including native and byproduct	37	37	--	All from United Kingdom.
Colloidal, precipitated, sublimed kilograms	2,246	618	--	Netherlands 600; United Kingdom 14; West Germany 4.
Dioxide do	183	40,715	40,704	United Kingdom 11.
Sulfuric acid	5,126	5,800	1,580	Spain 3,875; West Germany 229.
Talc, steatite, soapstone, pyrophyllite	621	507	312	Norway 151; United Kingdom 19.
Other:				
Crude	72	590	590	
Slag and dross, not metal-bearing	55	127	127	
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	5	2	2	
Carbon black	1,077	790	154	Venezuela 634; United Kingdom 2.
Coal: All grades including briquets	1,441	1,564	1,556	United Kingdom 5; Canada 3.
Coke and semicoke	49	253	223	West Germany 20; United Kingdom 10.
Peat including briquets and litter	11,672	1,304	212	Canada 841; Ireland 120.
Petroleum:				
Crude thousand 42-gallon barrels	1,286	(2)	(2)	
Refinery products:				
Liquefied petroleum gas 42-gallon barrels	709	95	8	Italy 86; United Kingdom 1.
Gasoline do	r25	31	--	All from United Kingdom.
Mineral jelly and wax do	3,533	5,107	1,255	United Kingdom 2,664; West Germany 681.
Kerosene and jet fuel do	(3)	80,396	--	Venezuela 52,708; Argentina 27,688.
Distillate fuel oil do	160,755	893,021	855	Venezuela 871,239; Panama 20,354.
Lubricants including nonlubricating oils do	63,038	82,799	17,548	Netherlands Antilles 42,573; United Kingdom 8,307.
Residual fuel oil do	57,873	667,638	667,625	Belgium-Luxembourg 13.
Bitumen and other residues do	109	91	18	United Kingdom 73.
Bituminous mixtures do	8,242	479	121	Canada 194; United Kingdom 158.
Petroleum coke do	671	3,036	3,036	

rRevised.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Revised to zero.

The Mineral Industry of Central American Countries

By H. Robert Ensminger[1]

CONTENTS

BELIZE

The Belizean economy had an estimated annual growth of about 3.4% over that of 1986. Economic growth during the 2 previous years was slower and was characterized by a negative trade balance. The gross domestic product (GDP) was an estimated $200 million[2] in current dollars. Limited natural resources and scarce finances continued to make the Government's task a difficult one. Belize and China signed an economic cooperation agreement in April under which the Chinese Government is to provide technical assistance, a cash grant of $50,000, and a long-term, interest-free loan of approximately $1.5 million. In May, it was reported that gold was discovered in a remote area of the Maya Mountains in western Belize. An estimated unassayed value of $400 million has been placed on the deposit by one of its discoverers. However, the government in Belmopan has played down the discovery.

Two U.S. oil companies, Seahawk Oil International of California and Alston Oil Co. of Texas, were granted licenses to explore for oil. Seahawk Oil will explore a large area of the Orange and Corozal Districts, while Alston Oil will prospect a 90,000-acre area of the western Cayo District. Another U.S. oil company, Pecten Oil Co., recently completed seismic studies offshore of Belize City. Pecten Oil has made plans to start drilling in 1988.

Table 1.—Central American Countries: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Country and commodity	1983	1984	1985	1986[p]	1987[e]
BELIZE					
Stone, sand and gravel:[e]					
Limestone	[2]608,860	600,000	600,000	600,000	600,000
Sand and gravel	[2]554,370	500,000	500,000	500,000	500,000
COSTA RICA					
Cement	385,300	468,600	475,500	520,000	[2]556,360
Clays: Kaolin	[e]500	[e]500	--	--	--
Diatomite	[e]450	[e]450	--	--	--
Gold[e] troy ounces	30,000	35,000	[2 3]15,997	[2 3]11,600	[2 3]9,645
Lime[e]	10,000	10,000	10,000	10,000	10,000
Petroleum refinery products thousand 42-gallon barrels	2,298	2,200	3,045	[e]3,000	[2]4,594
Pumice[e]	1,500	1,500	1,500	1,500	[2]6,000
Salt, marine[e]	110,000	110,000	[2]29,484	30,000	[2]12,650
Silver[e] troy ounces	2,000	2,000	2,000	2,000	2,000
Stone, sand and gravel:					
Crushed rock and rough stone[e] cubic meters	525,000	500,000	500,000	500,000	500,000
Limestone and other calcareous materials[e]	110,000	100,000	100,000	100,000	100,000
Sand and gravel[e] cubic meters	280,000	250,000	250,000	250,000	[2]80,000
EL SALVADOR					
Aluminum metal including alloys, semimanufactures	1,344	1,154	1,266	1,295	[2]1,526
Cement	[r]434,951	[r]399,170	450,026	442,625	[2]606,462
Gold troy ounces	650	285	--	--	--
Gypsum[e]	4,500	4,500	4,000	4,000	4,500
Iron and steel: Metal:					
Steel, crude	15,281	11,197	11,845	[e]11,000	11,500
Semimanufactures	15,799	27,985	23,472	35,460	[2]32,654
Limestone	850,000	870,000	890,000	[e]900,000	[2]1,450,000
Petroleum refinery products thousand 42-gallon barrels	[e]4,000	4,450	4,831	[e]4,800	4,800
Salt, marine[e]	2,000	2,500	2,700	[2]2,950	[2]3,100
Silver, fine troy ounces	21,988	21,750	--	--	--
GUATEMALA					
Antimony, mine output, Sb content	--	90	1,057	1,898	[2]1,605
Barite[e]	300	300	[2]2,402	[r]2,000	--
Cement thousand metric tons	452	[r]419	526	644	[2]1,324
Clays:					
Bentonite	[e]8,000	8,500	2,727	[r e]2,500	2,660
Kaolin	--	--	--	2,653	[2]1,879
Unspecified	137,672	[e]144,000	175,364	[e]175,000	175,000
Copper, Cu content of concentrates	--	--	4,454	[e]4,200	--
Feldspar	[e]6,000	5,000	5,582	[r e]4,200	[2]7,669
Gas, natural, gross million cubic feet	1,118	1,200	1,000	[e]1,100	[2]600
Gypsum, crude:					
For cement manufacture	16,588	14,635	16,868	28,322	[2]23,733
Other	[e]22,000	11,017	--	72,491	--
Iron and steel:					
Iron ore, gross weight	860	365	705	6,878	6,800
Steel, crude	28,000	26,600	10,277	[e]10,300	--
Semimanufactures	34,892	34,500	19,200	[e]19,000	19,000
Lead, metal including secondary	60	64	70	78	[2]92
Lime	27,091	50,534	61,761	36,798	[2]79,418
Petroleum:					
Crude thousand 42-gallon barrels	2,549	1,759	1,068	1,825	[2]1,460
Refinery products do.	4,306	4,760	4,926	3,821	3,800
Pumice and related materials:					
Pumice[e]	15,000	13,200	12,000	[2]10,984	[2]15,190
Volcanic ash	[e]100	200	--	1,073	[2]1,528
Salt[e]	15,100	16,000	17,300	[r]39,400	[2]37,088
Stone, sand and gravel:					
Limestone thousand tons	[e]1,215	1,200	990	1,938	[2]467
Marble cubic meters	[e]1,000	1,200	380	1,332	[2]1,330
Sand and gravel do.	[e]525,000	370,000	315,737	225,570	[2]378,157
Sand, silica	[e]18,400	18,000	22,355	[r e]22,000	[2]30,665
Tungsten, mine output, W content of concentrate	--	--	6	9	--
HONDURAS					
Antimony, mine output, Sb content	--	111	87	[e]100	[2]80
Cadmium, mine output, Cd content	386	415	598	[e]350	[2]125
Cement	485,435	534,183	347,500	[r e]350,000	400,000
Copper, Cu content of lead and zinc concentrates	[e]650	770	5,051	[e]5,000	[2]582

See footnotes at end of table.

Table 1.—Central American Countries: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Country and commodity	1983	1984	1985	1986[p]	1987[e]
HONDURAS —Continued					
Gold ___ troy ounces	2,151	2,784	5,023	2,018	[2]4,222
Gypsum[e]	22,000	22,000	22,000	22,000	22,000
Iron and steel: Metal, semimanufactures[e]	20,000	22,000	[2]11,850	12,000	12,000
Lead, mine output, Pb content	19,291	20,544	21,250	12,558	[2]4,573
Petroleum refinery products thousand 42-gallon barrels	3,938	3,303	2,386	1,472	1,500
Salt[e]	30,000	30,000	30,000	30,000	30,000
Silver ___ thousand troy ounces	2,587	2,697	2,765	1,745	[2]747
Stone:[e]					
Limestone	500,000	500,000	500,000	500,000	[2]448,820
Marble	40,000	40,000	40,000	[2]6,726	[2]962
Zinc, mine output, Zn content	37,980	41,483	44,026	25,443	[2]15,495
NICARAGUA					
Cement[e]	100,000	100,000	100,000	100,000	100,000
Gold, mine output, Au content ___ troy ounces	46,428	[e]35,000	25,316	28,664	[2]30,486
Gypsum and anhydrite, crude	11,350	[e]10,000	8,310	[e]8,000	[2]7,299
Lime	4,700	[e]3,000	3,702	[e]3,500	3,500
Petroleum refinery products thousand 42-gallon barrels	3,914	3,277	3,715	[e]3,700	3,500
Salt, marine[e]	18,000	15,000	15,000	15,000	15,000
Sand and gravel ___ cubic meters	[2]481,743	490,000	450,000	450,000	450,000
Silver, mine output, Ag content ___ troy ounces	63,417	[e]50,000	29,665	[e]25,000	[2]28,558
PANAMA					
Cement	326,170	303,950	305,200	336,000	350,000
Clays and clay products:					
Crude	58,284	71,104	98,382	111,335	115,000
Products ___ cubic meters	18,255	32,649	37,343	29,598	30,000
Manganese ore	--	--	--	6,000	6,000
Petroleum refinery products thousand 42-gallon barrels	11,755	10,622	8,864	[e]9,000	9,000
Salt, marine[4]	85,491	18,585	16,024	9,816	10,000
Stone, sand and gravel:					
Limestone[5]	448,145	212,205	293,726	462,414	450,000
Sand and gravel ___ thousand cubic meters	802	712	674	669	700
Sand, silica	26,779	[e]20,000	13,882	16,290	17,000

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

[1]Includes data available through July 15, 1988.

[2]Reported figure.

[3]Gold from placer deposits and mines purchased by Banco Central. Actual production estimated to be at least twice that amount.

[4]Represents sales. Figures for 1983 reflect crude salt production.

[5]Excludes approximately 8,000 cubic meters per year, apparently dimension stone.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Destinations, 1985	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys, semimanufactures ___ value, thousands	$12	$1	--	All to Mexico.
Copper: Metal including alloys, semimanufactures ___ do	$1	--		
Iron and steel: Metal:				
Scrap	428	592	--	Mexico 374; Colombia 218.
Semimanufactures:				
Bars, rods, angles, shapes, sections	3	--		
Universals, plates, sheets	26	23	--	Guatemala 19; United Kingdom 4.
Tubes, pipes, fittings	22	74	--	Mainly to Colombia.
INDUSTRIAL MINERALS				
Clays, crude	(2)	4	4	
Lime ___ value, thousands	--	$1	--	All to Colombia.
Sodium compounds, n.e.s.: Carbonate, manufactured ___ do	--	$2	--	Do.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Destinations, 1985	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Gravel and crushed rock	42	--		
Sand other than metal-bearing	155	1	1	
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline, motor--42-gallon barrels	24,914	43,385	21,531	Mexico 21,854.
Kerosene and jet fuel ---do---	61,675	38,293	14,841	Mexico 23,452.
Distillate fuel oil ---do---	4,513	3,171	1,582	Trinidad and Tobago 589; Colombia 395.
Lubricants--- value, thousands--	$1	--		

[1]Table prepared by Linda Williams.
[2]Less than 1/2 unit.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys, semimanufactures	91	64	42	Jamaica 6; United Kingdom 6.
Copper: Metal including alloys, semimanufactures	13	25	21	Canada 3; Netherlands 1.
Iron and steel: Metal:				
Steel, primary forms	5	(2)	(2)	
Semimanufactures:				
Bars, rods, angles, shapes, sections	37,071	1,501	140	Mexico 992; Guatemala 143.
Universals, plates, sheets	103,146	791	111	United Kingdom 350; Jamaica 103.
Hoop and strip	26	19	19	
Rails and accessories	--	9	9	
Wire	1,488	257	6	Mexico 130; United Kingdom 114.
Tubes, pipes, fittings	239	300	138	United Kingdom 41; West Germany 34.
Castings and forgings, rough	1	1	NA	NA.
Lead: Metal including alloys, semimanufactures -- value, thousands--	$5	$3	$1	Brazil $1; Canada $1.
Silver: Waste and sweepings ---do---	$1	--		
Tin: Metal including alloys, semimanufactures	$2	$5	$1	United Kingdom $4.
Zinc:				
Blue powder ---do---	--	$1	$1	
Metal including alloys, semimanufactures	1	1	1	
Other:				
Oxides and hydroxides	1	--		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	2	2	2	
Cement	20,441	21,622	51	Mexico 20,660; Venezuela 848.
Clays, crude	-	599	599	
Fertilizer materials: Manufactured:				
Ammonia	5	8	8	
Nitrogenous	2,271	1,688	720	Mexico 649; Honduras 319.
Phosphatic	--	31	31	
Potassic	595	64	3	Netherlands 54; Mexico 7.
Unspecified and mixed	2,054	3,491	3,491	
Lime	765	832	3	Mexico 811; Guatemala 17.
Pigments, mineral: Natural, crude	1	2	2	
Potassium salts, crude	178	108	19	Honduras 89.
Salt and brine	595	565	229	Mexico 209; United Kingdom 96.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	3	2	(2)	Mainly from Mexico.
Sulfate, manufactured	147	119	3	Jamaica 116.
Stone, sand and gravel:				
Dimension stone, worked	1	3	2	Mexico 1.
Gravel and crushed rock	7	1	1	
Sand other than metal-bearing	36	17	17	
Sulfuric acid	20	36	6	Guatemala 20; Mexico 10.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1	538	--	All from Trinidad and Tobago.
Coal: All grades excluding briquets	1	--	--	
Peat including briquets and litter	--	2	2	
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	35,600	34,452	([2])	Mexico 34,197; Guatemala 244.
Gasoline, motor do.	187,535	196,936	141,848	Netherlands Antilles 55,088.
Mineral jelly and wax do.	55	55	8	Guatemala 16; United Kingdom 16.
Kerosene and jet fuel do.	99,494	114,196	81,685	Netherlands Antilles 32,511.
Distillate fuel oil do.	235,900	222,733	158,682	Netherlands Antilles 64,051.
Lubricants do.	10,633	9,884	5,376	Netherlands Antilles 3,850; Jamaica 385.
Nonlubricating oils do.	364	1,008	945	Canada 63.
Residual fuel oil do.	9,277	9,530	--	Mexico 7,805; Guatemala 1,725.
Bitumen and other residues do.	--	2,527	--	All from El Salvador.
Bituminous mixtures do.	97	54	36	United Kingdom 18.

NA Not available.
[1]Table prepared by Linda Williams.
[2]Less than 1/2 unit.

COSTA RICA

In 1987, the mining sector played a minor role in Costa Rica's economic development. It produced limited amounts of diatomite, gold, kaolin, marine salt, and silver. Deposits of bauxite, coal, copper, iron ore, manganese, mercury, and sulfur have been found, but thus far have not been developed.

Costa Rica's relative prosperity has stemmed mainly from its political stability; however, despite this, the economic growth declined 2.4%. The 1987 GDP was $4.1 billion[3] in current dollars, compared with $4.2 billion for 1986. A new economic program was adopted by the Government, aimed primarily at reducing the rate of inflation and stabilizing the conditions deemed necessary for continued growth.

In 1987, the emphasis was on the development of Costa Rica's gold potential, as evidenced by the inauguration of a number of exploration programs by the Ministry of Natural Resources, Energy and Mines. One of these programs involved the contracting of Sveriges Geologiska AB, a Swedish exploration group, to assist in exploratory drilling, sampling, and mine rehabilitation. A state mining enterprise, Minera Nacional S.A. (MINASA), was formed. This group recently financed jointly with the British Overseas Development Administration a study of the geology and gold mineralization of the Osa Peninsula. The study was to be done by the British Geological Survey.

The rich placer deposits of the Osa Peninsula form part of the gold province of southern Costa Rica. They account for most of the gold production in Costa Rica, having been estimated to yield 14,600 troy ounces annually. The 1987 production was believed to be at least twice that produced in Costa Rica's other gold province, the Tilaran-Aquacate region situated in the northwestern part of the country, and four times as much if unrecorded sales were taken into account. The Banco Central de Costa Rica has been the sole legal purchaser of gold since 1981. Minas de Sierra Alto S.A., a subsidiary of NorQuest Resources Ltd. of Canada, has identified a deposit of gold-bearing sulfides in the Las Juntas region. The deposit is believed to be workable by open pit methods with reserves at the San Martin ore body estimated at 650,000 tons averaging 3.8 grams of gold per ton. Greenstone Resources of Canada Ltd. drilled a number of exploratory holes on its 800-hectare El Recio claim in the Abangares Goldfields. It was reported that the goldfields primarily comprised four major epithermal gold-silver vein systems from which gold can be extracted by heap leaching in near-surface zones, with higher grade reserves occurring underground. Combined reserves total approximately 1 million tons of ore containing more than 150,000 ounces of gold.

Mining of low-grade bauxite deposits, estimated to contain 150 million tons of ore and situated southeast of San Isidro, remained under consideration as an integral part of an aluminum smelting project that would utilize energy generated by the proposed 760-megawatt Boruca hydroelectric plant in southern Costa Rica. Among the most prospective nongold mineral discoveries was the Pueblo Nuevo deposit, 70 kilometers southeast of San Jose, containing an estimated 3.5 million tons of ore averaging 18% copper.

Dependence on imported petroleum continued. The development of the country's hydroelectric and geothermal power resources proceeded slowly and initially was based on a 55-megawatt geothermal powerplant under construction at the Miravelle Volcano. Costa Rica's only petroleum refinery, on the Caribbean coast at Puerto Limón, operated using oil made available at preferential prices from Mexico and Venezuela under the San Jose Agreement.

EL SALVADOR

The economy showed an estimated growth of 2.4% over that of 1986 to an estimated $4.4 billion[4] in current dollars. In recent years there has been considerable reliance on foreign aid, amounting in the last fiscal year to about $770 million from the United States and $230 million mainly from the Federal Republic of Germany and Italy.

The Comisión Ejecutiva Hidroelectrica del Rio Lempa (CEL), the state power utility, at midyear reported that the current actual generating capacity of its major installations was 555 megawatts, which was 13% below rated capacity. Estimates indicated that these facilities should be adequate to meet El Salvador's electrical energy demands through 1992.

Table 4.—El Salvador: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	Destinations, 1984	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Unwrought	99	45	--	All to Guatemala.
Semimanufactures	1,476	1,942	4	Guatemala 1,452; Costa Rica 284; Panama 109.
Iron and steel: Metal:				
Scrap	--	15	15	
Pig iron, cast iron, related materials	2	--		
Semimanufactures	81	298	--	Guatemala 202; Honduras 96.
Lead: Metal including alloys, semimanufactures	6	7	--	All to Guatemala.
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$231	$220	--	All to Switzerland.
Other: Base metals including alloys, all forms	170	20	--	All to Guatemala.
INDUSTRIAL MINERALS				
Cement	43,284	32,558	--	Do.
Clays, crude	387	403	--	Panama 345; Costa Rica 58.
Fertilizer materials: Manufactured:				
Nitrogenous	--	93	--	All to Costa Rica.
Phosphatic	20	--		
Salt and brine	12,824	12,857	--	Guatemala 12,797; Honduras 60.
Sulfur: Sulfuric acid	1,130	1,825	--	Guatemala 973; Costa Rica 792; Nicaragua 60.
Other: Crude	36	31	--	All to Guatemala.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline, motor, 42-gallon barrels	1,130	196	--	Do.
Mineral jelly and wax, do.	31	--		
Distillate fuel oil, do.	447,764	595,532	--	All to Netherlands Antilles.
Lubricants, do.	8,911	16,247	--	Guatemala 13,216; Nicaragua 1,540; Costa Rica 973.
Residual fuel oil, do.	(2)	--		

[1]Table prepared by H. D. Willis.
[2]Revised to zero.

Table 5.—El Salvador: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Unwrought	1,530	1,248	410	Venezuela 402; Canada 361.
Semimanufactures	2,546	2,240	1,027	West Germany 517; Belgium-Luxembourg 184.
Copper: Metal including alloys:				
Unwrought	2	30	1	Mexico 20; Belgium-Luxembourg 9.
Semimanufactures	1,793	1,431	79	Peru 831; Mexico 308; Costa Rica 105.
Iron and steel: Metal:				
Scrap	186	4,663	4,202	Guatemala 390; West Germany 71.
Pig iron, cast iron, related materials	9	--		
Ferroalloys	304	151	--	Belgium-Luxembourg 69; West Germany 52; Mexico 30.
Steel, primary forms	2,000	15,654	5,964	Venezuela 8,527; Chile 509.
Semimanufactures:				
Bars, rods, angles, shapes, sections	7,694	8,895	663	Guatemala 4,089; Costa Rica 767.
Universals, plates, sheets	21,758	18,873	945	Republic of Korea 5,781; Japan 5,032; West Germany 2,983.
Hoop and strip	463	490	23	West Germany 406; Japan 18.
Wire	6,451	7,031	453	Mexico 2,873; Venezuela 998; Guatemala 878.
Tubes, pipes, fittings	5,396	4,011	471	Guatemala 2,798; Costa Rica 449.
Castings and forgings, rough	--	6	5	Mexico 1.
Lead: Metal including alloys:				
Unwrought	56	40	--	All from Mexico.
Semimanufactures	114	131	4	Mexico 125; Japan 1.
Nickel: Metal including alloys:				
Unwrought value, thousands	--	$1	$1	
Semimanufactures	1	4	1	Canada 1; Mexico 1.
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$30	$65	$1	Switzerland $64.
Tin: Metal including alloys:				
Unwrought	3	5	1	Guatemala 1; United Kingdom 1.
Semimanufactures	6	7	1	United Kingdom 4; Netherlands 1.
Zinc: Metal including alloys:				
Unwrought	1,016	609	6	Mexico 519; Peru 84.
Semimanufactures	15	8	2	Mexico 5; Guatemala 1.
Other:				
Ores and concentrates	2	8	--	Spain 6; West Germany 2.
Ashes and residues	2	22	--	All from Guatemala.
Base metals including alloys, all forms	r5	9	1	Netherlands 6; West Germany 2.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	653	678	8	Guatemala 664; Italy 4.
Grinding and polishing wheels and stones	87	73	3	Brazil 21; West Germany 15; Czechoslovakia 8.
Asbestos, crude	3,955	1,989	--	All from Canada.
Boron materials: Oxides and acids	3	17	14	West Germany 2; Netherlands 1.
Cement	1,015	14,985	--	Guatemala 14,020; West Germany 461; Denmark 176.
Clays, crude	5,413	4,739	826	Guatemala 3,873; Mexico 26.
Diatomite and other infusorial earth	544	445	220	Mexico 208; West Germany 17.
Fertilizer materials: Manufactured:				
Nitrogenous	215,662	173,598	118,749	Belgium-Luxembourg 20,008; West Germany 9,014.
Phosphatic	164	21,423	5,706	Colombia 5,397; Romania 5,224.
Potassic	240	11	1	Mexico 10.
Unspecified and mixed	34,196	48,706	12,049	Romania 13,228; Spain 12,025.
Graphite, natural value, thousands	$9	$2	$2	
Gypsum and plaster	10,595	12,979	11	Guatemala 12,693; Honduras 233; West Germany 25.
Lime	1,163	1,781	--	All from Guatemala.
Mica: Crude including splittings and waste	4	3	3	
Phosphates, crude	21	41	20	West Germany 21.
Precious and semiprecious stones other than diamond, natural value, thousands	$42	$24	--	West Germany $14; Switzerland $10.
Salt and brine	82	75	21	Canada 41; West Germany 13.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	5,514	4,691	2,651	West Germany 763; Netherlands 604.
Sulfate, manufactured	18	7	1	West Germany 6.

See footnotes at end of table.

Table 5.—El Salvador: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	2,329	2,506	--	All from Guatemala.
Worked	83	162	--	Do.
Gravel and crushed rock	1,237	440	35	Guatemala 386; Mexico 19.
Limestone other than dimension	5,825	5,198	87	Guatemala 4,513; Mexico 280; Costa Rica 175.
Quartz and quartzite	353	379	1	Mexico 378.
Sulfur:				
Elemental: Crude including native and byproduct	2,481	3,181	3,030	Mexico 151.
Sulfuric acid	1,305	9	2	West Germany 6; Guatemala 1.
Talc, steatite, soapstone, pyrophyllite	390	426	180	Guatemala 147; Hong Kong 30.
MINERAL FUELS AND RELATED MATERIALS				
Coal, all grades excluding briquets	187	132	60	West Germany 60; Colombia 10.
Coke and semicoke	363	194	10	West Germany 120; Colombia 55.
Petroleum:				
Crude thousand 42-gallon barrels	5,159	10,943	--	Mexico 6,363; Venezuela 4,580.
Refinery products:				
Gasoline, motor do.	61	68	8	Guatemala 38; Netherlands Antilles 22.
Mineral jelly and wax do.	17	15	9	West Germany 3; Japan 2.
Kerosene and jet fuel do.	7	7	5	Bermuda 1; Netherlands Antilles 1.
Lubricants do.	43	41	29	Netherlands Antilles 6; Jamaica 5.

[r]Revised.
[1]Table prepared by H. D. Willis.

Mineral production during 1987 was very limited, being confined primarily to gold, limestone, and silver. Other mineral occurrences reported included copper, iron ore, lead, mercury, perlite, sulfur, and zinc. However, little progress was made toward the development of these deposits. Gold was produced by Minas San Cristobal S.A., a subsidiary of Javelin International Ltd. of Canada, from its underground mine at San Cristobal in Morazan Department. Another gold-silver property is about 56 kilometers northeast of San Salvador, where development and rehabilitation have been undertaken by the Bruneau Mining Corp. of Canada. The deposit has been estimated to contain 200,000 tons of reserves grading 6.2 grams of gold and 23.56 grams of silver per ton.

In recent years there has been virtually no oil exploration, offshore or onshore. As a consequence, El Salvador has had to rely entirely on imported oil to meet the needs of the 17,000-barrel-per-day Acajutla refinery. Alternative energy sources have been developed, such as the hydroelectric power stations at Cerron Grande and San Lorenzo on the Lempa River. The Government developed plans to divert a portion of the country's sugar cane production toward a sugar-based ethanol program for which it has reportedly secured a $30.4 million loan from Venezuela.

GUATEMALA

Prospects for continued improvement in economic performance were diminished by an upsurge of guerrila activity toward year-end. In addition, an early end to the rainy season adversely affected the basic grain and coffee crops, and presented problems for the hydroelectric sector. Nevertheless the economy grew by an estimated 2% with the GDP reaching an estimated $8.4 billion[5] in current dollars.

The mining and mineral sectors remained rather restricted, with only limited production reported of antimony, feldspar, gypsum, iron ore, lead, limestone, marble, and sand and gravel. Lead production has been about 75 to 100 tons per year in recent years from the Ballena, Montenegro, and Penasco Mines operated in Chiquimula State in southwestern Guatemala by Cía. Minas de Oriente S.A. (MINERSA). Ore reserves were estimated at 2.2 million tons averaging 86 grams of silver per ton, 0.58% lead, and 4.28% zinc. The Annabella and Los Lirios antimony-tungsten mines owned by Minas de Guatemala S.A. at Iztahuacán near the Mexican border have been producing at the rate of 1,800 tons of ore per month averaging 6% antimony and 0.5% lead.

Petroleum production in Guatemala was from the Lower Cretaceous reservoirs of the Rubelsanto and West Chinaja Fields in northern Guatemala by the French oil concern, Société Nationale Elf Aquitaine, for the Petromaya consortium, a joint venture with Basic Resources International S.A. The crude oil produced was transported by a 200-kilometer pipeline from Rubelsanto to the Caribbean terminal of Puerto Barrios for shipment to Louisiana. A new well near the Alta Verapaz and Peten boundary was estimated to yield 2,000 barrels per day, roughly equivalent to one-third of current national production.

The Chixoy hydroelectric powerplant, reportedly the largest in Central America, has the capacity to provide about 90% of the country's electrical power requirements. However, because of the premature end to the rainy season, the water level at the dam fell below that deemed necessary for maximum output, and consequently, the Government-owned National Electrification Institute (INDE) was forced to reactivate some of the country's thermal power generators.

Table 6.—Guatemala: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	Destinations, 1984	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	1	2	--	All to El Salvador.
Metal including alloys, semimanufactures	630	190	--	El Salvador 92; Honduras 89; Costa Rica 7.
Copper:				
Ore and concentrate	12	111	50	Belgium-Luxembourg 61.
Metal including alloys:				
Unwrought	122	60	41	Netherlands 19.
Semimanufactures	521	56	2	Belgium-Luxembourg 20; Netherlands 18; West Germany 16.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	2,902	2,299	--	El Salvador 2,278; Costa Rica 21.
Metal:				
Scrap	3	396	--	All to El Salvador.
Pig iron, cast iron, related materials	41	66	--	Honduras 43; Belize 23.
Semimanufactures:				
Bars, rods, angles, shapes, sections	5,616	4,255	--	El Salvador 3,733; Honduras 514; Belize 8.
Universals, plates, sheets	3,123	1,183	--	El Salvador 867; Nicaragua 224; Honduras 90.
Hoop and strip	52	86	--	Honduras 77; El Salvador 9.
Rails and accessories	2	--		
Wire	1,421	1,396	--	El Salvador 1,031; Nicaragua 244; Costa Rica 100.
Tubes, pipes, fittings	6,045	3,670	--	El Salvador 2,756; Honduras 889; Nicaragua 25.
Castings and forgings, rough	5	1	--	All to El Salvador.

See footnote at end of table.

Table 6.—Guatemala: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	Destinations, 1984	
			United States	Other (principal)
METALS —Continued				
Lead:				
Oxides	1	--		
Metal including alloys, semimanufactures	4	5	--	All to Honduras.
Magnesium: Metal including alloys, semimanufactures	10	--		
Manganese: Oxides	1	--		
Tin: Metal including alloys, semimanufactures value, thousands	--	$2	--	All to El Salvador.
Tungsten: Metal including alloys, all forms	255	71	42	West Germany 15; Honduras 14.
Zinc:				
Oxides	14	9	--	Honduras 7; El Salvador 2.
Metal including alloys:				
Unwrought	73	1	--	All to El Salvador.
Semimanufactures	70	28	--	All to Honduras.
Other: Ashes and residues	74	161	89	Netherlands 50; West Germany 20.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	313	765	--	All to El Salvador.
Grinding and polishing wheels and stones	29	28	--	El Salvador 27; Honduras 1.
Cement	115	13,674	--	All to El Salvador.
Clays, crude	7,977	4,745	--	El Salvador 3,916; Honduras 362; Costa Rica 277.
Cryolite and chiolite	3,123	3,542	--	Costa Rica 2,662; Panama 800; El Salvador 80.
Diamond: Gem, not set or strung value, thousands	$2	--		
Diatomite and other infusorial earth	77	41	--	All to Costa Rica.
Fertilizer materials: Manufactured:				
Ammonia value, thousands	$5	$1	--	All to El Salvador.
Nitrogenous	NA	58,884	2,661	Mexico 54,430; Canada 1,730.
Potassic	184	--		
Unspecified and mixed	13	--		
Graphite, natural value, thousands	$5	$1	--	All to El Salvador.
Gypsum and plaster	10,792	13,277	--	El Salvador 12,387; Costa Rica 890.
Lime	1,212	1,940	--	El Salvador 1,750; Costa Rica 190.
Nitrates, crude	--	20	--	Honduras 19; El Salvador 1.
Salt and brine	21	11	--	All to Mexico.
Sodium compounds, n.e.s.: Carbonate, manufactured	96	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	2,646	3,683	83	El Salvador 2,393; Japan 716; Colombia 319.
Worked	943	1,281	851	El Salvador 247; Mexico 66.
Sand other than metal-bearing	3,060	1,540	--	El Salvador 1,021; Costa Rica 519.
Sulfur: Sulfuric acid	14	40	--	El Salvador 21; Belize 18; Costa Rica 1.
Talc, steatite, soapstone, pyrophyllite	289	270	--	El Salvador 165; Costa Rica 101; Honduras 4.
Other: Crude	2,579	2,345	--	El Salvador 2,325; Honduras 20.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	--	60	--	Italy 40; Costa Rica 20.
Coal:				
Anthracite and bituminous	3	--		
Lignite including briquets	2	1	--	All to Honduras.
Coke and semicoke	5	--		
Petroleum:				
Crude 42-gallon barrels	1,878,918	987,522	904,996	Panama 82,526.
Refinery products:				
Liquefied petroleum gas do	--	128	--	All to El Salvador.
Gasoline, motor do	10,515	--		
Mineral jelly and wax do	79	--		
Distillate fuel oil do	7	--		
Lubricants do	686	364	--	El Salvador 175; Costa Rica 119; Honduras 49.

NA Not available.

[1]Table prepared by Linda Williams.

Table 7.—Guatemala: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	4,283	2,526	185	Mexico 693; Panama 615; Jamaica 319.
Metal including alloys:				
Unwrought	248	942	(2)	Netherlands 379; Canada 237; France 202.
Semimanufactures	2,508	1,822	124	El Salvador 774; West Germany 374; Spain 268.
Cobalt: Oxides and hydroxides	5	2	(2)	Mainly from Netherlands.
Copper:				
Ore and concentrate	2,200	1,223	397	Mexico 778; West Germany 21.
Metal including alloys:				
Unwrought	3	62	--	Canada 50; Republic of South Africa 12.
Semimanufactures	291	188	111	Brazil 30; Mexico 29.
Iron and steel: Metal:				
Pig iron, cast iron, related materials	12,472	22,149	13,360	Mexico 3,005; Venezuela 2,941.
Semimanufactures:				
Bars, rods, angles, shapes, sections	10,179	12,783	257	Nicaragua 5,379; Republic of Korea 2,662; Belgium-Luxembourg 1,772.
Universals, plates, sheets	47,810	42,387	3,978	Japan 18,302; France 11,966.
Hoop and strip	779	810	84	West Germany 356; Japan 233.
Rails and accessories	336	11	--	All from Belgium-Luxembourg.
Wire	23,877	13,796	198	Mexico 3,074; Venezuela 2,589; West Germany 2,148.
Tubes, pipes, fittings	9,902	4,740	2,298	Canada 1,572; Venezuela 210.
Castings and forgings, rough	463	172	141	France 12; Spain 5.
Lead:				
Oxides	440	350	2	Mexico 323; Honduras 22.
Metal including alloys:				
Unwrought	2	2	2	
Semimanufactures	42	46	--	Peru 28; Honduras 11; El Salvador 7.
Magnesium: Metal including alloys, semimanufactures	14	2	NA	Mainly from Peru.
Manganese: Oxides	44	70	61	Belgium-Luxembourg 9.
Nickel: Metal including alloys:				
Unwrought	2	1	1	
Semimanufactures	5	7	3	West Germany 3; Canada 1.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$3	--		
Silver: Metal including alloys, unwrought and partly wrought do	$5	$3	$3	
Tin: Metal including alloys:				
Unwrought	3	6	1	Mexico 2; United Kingdom 2.
Semimanufactures	3	9	4	United Kingdom 3; Denmark 1.
Tungsten: Metal including alloys, all forms	10	9	6	Belgium-Luxembourg 3.
Zinc:				
Oxides	247	371	119	Mexico 112; West Germany 51.
Metal including alloys:				
Unwrought	2,948	2,904	--	Mexico 2,116; Canada 772; Honduras 11.
Semimanufactures	48	59	5	Canada 51; Panama 2.
Other:				
Oxides and hydroxides	214	281	68	West Germany 82; Austria 50.
Ashes and residues	294	120	--	Nicaragua 100; El Salvador 20.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	6	7	4	Brazil 2; Mexico 1.
Grinding and polishing wheels and stones	124	137	5	Brazil 56; Italy 21; Spain 14.
Asbestos, crude	681	680	6	Canada 659; Italy 15.
Boron materials: Oxides and acids	6	24	5	West Germany 5; Mexico 4.
Cement	44,212	32,346	276	El Salvador 31,362; Mexico 406.
Clays, crude	3,266	3,160	2,886	Mexico 144; West Germany 78.
Diamond: Industrial stones value, thousands	$1	$1	--	All from West Germany.
Diatomite and other infusorial earth	714	427	23	Mexico 404.

See footnotes at end of table.

Table 7.—Guatemala: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Fertilizer materials:				
Crude, n.e.s	2	--		
Manufactured:				
Ammonia	1,739	1,821	42	Mexico 1,227; Japan 432; West Germany 78.
Nitrogenous	96,070	115,684	27,753	Netherlands 49,143; Mexico 12,680.
Potassic	6,889	27,454	8,156	West Germany 15,041; Netherlands 3,557.
Unspecified and mixed	5,827	54,110	6,101	Netherlands 32,020; Norway 7,646.
Graphite, natural	49	9	2	Mexico 5; Italy 2.
Gypsum and plaster	33	49	48	Canada 1.
Lime	26	13	6	Mexico 4; Canada 3.
Mica: Crude including splittings and waste	9	11	3	France 8.
Nitrates, crude	10	20	--	All from Chile.
Pigments, mineral:				
Natural, crude	162	--		
Iron oxides and hydroxides, processed	185	290	79	Netherlands 154; Belgium-Luxembourg 24.
Precious and semiprecious stones other than diamond: Natural value, thousands	--	$1	$1	
Salt and brine	14,808	6,365	8	El Salvador 6,170; Honduras 95; Nicaragua 69.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	8,843	8,526	6,353	Romania 746; East Germany 698.
Sulfate, manufactured	2,520	3,518	6	Mexico 3,475; West Germany 18; Nicaragua 14.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	48	36	--	Costa Rica 18; Mexico 18.
Worked	264	157	51	Costa Rica 88; El Salvador 13.
Quartz and quartzite	2	37	37	
Sand other than metal-bearing	44	34	1	Costa Rica 20; Mexico 13.
Sulfur:				
Elemental: Crude including native and byproduct	42	362	--	Mexico 301; Belgium-Luxembourg 56; West Germany 5.
Sulfuric acid	1,089	1,150	2	El Salvador 967; Mexico 147; Costa Rica 31.
Talc, steatite, soapstone, pyrophyllite	219	411	281	China 71; Japan 18.
Other: Crude	301	51	--	France 36; United Kingdom 15.
MINERAL FUELS AND RELATED MATERIALS				
Carbon, unspecified	2,912	2,199	57	Venezuela 1,859; West Germany 137; Canada 61.
Coal:				
Anthracite and bituminous	--	20	15	Mexico 5.
Lignite including briquets	16	109	20	Finland 58; Mexico 31.
Coke and semicoke	310	263	196	Mexico 67.
Petroleum:				
Crude, thousand 42-gallon barrels	3,030	11,549	--	Venezuela 6,622; Mexico 4,803; Trinidad and Tobago 124.
Refinery products:				
Liquefied petroleum gas do	199	729	689	Netherlands Antilles 20; Mexico 17.
Gasoline, motor do	878	1,148	(2)	Netherlands Antilles 1,090; Venezuela 54; Panama 3.
Mineral jelly and wax do	50	58	9	West Germany 34; Japan 6.
Kerosene and jet fuel do	164	218	7	Netherlands Antilles 207; Mexico 3.
Distillate fuel oil do	1,255	1,471	(2)	Netherlands Antilles 1,289; El Salvador 92; Trinidad and Tobago 35.
Lubricants do	114	126	53	Netherlands Antilles 26; Jamaica 25.

NA Not available.
[1]Table prepared by Linda Williams.
[2]Less than 1/2.

HONDURAS

In 1987, industry continued to play only a minor role in the country's economy, with gold and silver dominating the minerals sector. The GDP, estimated at $3.59 billion[e] in current dollars, reflected a 2% increase in the national output for the year. The unstable political situation in neighboring Central American countries hampered mine development and slowed exploration. Despite these problems, the French Bureau de Recherches Géologiques et Minières was contracted to carry out a mineral inventory on behalf of the Ministry of Natural Resources. The work included the production of geologic maps of the mineralized areas at a scale of 1:50,000. The program was funded jointly by the Inter-American Development Bank and the French Foreign Ministry.

In April 1987, U.S.-based AMAX Inc. announced that its subsidiary, Rosario Resources Corp., had sold its El Mochito lead-silver-zinc mine and related facilities to American Pacific Holdings Inc. (APH) of the United States. The mine was reopened in October at a production rate of 1,100 tons of ore per day with plans to raise production to 2,000 tons per day in 1988. The plans included focusing on the more recently explored underground sections of the ore body, where reserves were determined to be 5.5 million tons grading 3% to 4% lead, 8% to 10% zinc, 3 to 4 troy ounces of silver per ton, and about 0.6% copper. The mill has the capability to produce copper concentrate, but by yearend the equipment had not been hooked up, and efforts were continuing to tie the copper circuit into the operation.

In an agreement signed with the Government of Honduras, APH has the right to keep 60% of the dollars earned overseas from concentrate exports, with the balance of 40% being repatriated to the Government to cover local costs, including electricity, labor, and other supplies. In addition, APH will have to pay a 1% to 1.5% royalty on net revenues and an income tax. Import and export duties were removed, which will greatly improve the economic feasibility of the project. APH also has planned exploratory work on the nearby El Manzanal silver prospect and the San Juancito gold prospect.

Because of the lack of domestic oil and natural gas resources, in 1987, Honduras imported approximately 2.8 million barrels of oil, principally from Venezuela.

Plans were finalized for the full completion of the $600 million El Cajon hydroelectric power project on the Humuya River near San Pedro Sula in northwestern Honduras and the El Nispero project on the Palaja River in the Department of Santa Barbara. It was determined that by yearend 1988 Honduras would be in a position to export electricity to Costa Rica, Nicaragua, and Panama.

Table 8.—Honduras: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	Destinations, 1984	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Unwrought	10	--		
Semimanufactures	--	8	--	All to Guatemala.
Cadmium: Cd content of zinc concentrates	161	283	111	United Kingdom 76; Belgium-Luxembourg 57.
Copper:				
Ore and concentrate, Cu content	--	60	--	All to Belgium-Luxembourg.
Metal including alloys, semimanufactures	(2)	--		
Gold:				
Au content:				
Of lead concentrate value, thousands	$813	$293	$180	Japan $113.
In activated charcoal do.	$530	$880	$696	Canada $184.
Metal including alloys, unwrought do.	$64	--		

See footnotes at end of table.

Table 8.—Honduras: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	Destinations, 1984	
			United States	Other (principal)
METALS —Continued				
Iron and steel: Metal: Semimanufactures:				
Universals, plates, sheets	--	13	--	All to Guatemala.
Wire	998	149	--	Guatemala 98; Costa Rica 51.
Tubes, pipes, fittings	6	2	--	All to Panama.
Castings and forgings, rough	1	--		
Lead:				
Pb content:				
Of copper concentrate	--	257	--	All to Belgium-Luxembourg.
Of lead concentrate	17,264	17,893	7,819	Japan 10,074.
Of zinc concentrate	357	--		
Metal including alloys, semimanufactures	29	3	--	All to Guatemala.
Silver: Ag content:				
Of copper concentrate value, thousands	--	$192	--	All to Belgium-Luxembourg.
Of lead concentrate do.	$30,560	$21,137	$8,775	Japan $12,362.
Of silver concentrate do.	(2)	$26	$26	
Of zinc concentrate do.	$6,710	$4,486	$1,084	Belgium-Luxembourg $1,695; Italy $1,047.
In activated charcoal do.	$6	$5	$4	Canada $1.
Zinc:				
Ore and concentrate, Zn content	31,069	40,456	10,633	Belgium-Luxembourg 16,728; United Kingdom 7,459.
Metal including alloys:				
Unwrought	10	--		
Semimanufactures	(2)	11	--	All to Guatemala.
Other:				
Ashes and residues	85	552	552	
Base metals including alloys, all forms	(2)	170	170	
INDUSTRIAL MINERALS				
Asbestos, crude	20	--		
Clays, crude	--	24	--	El Salvador 17; Guatemala 7.
Fertilizer materials:				
Crude, n.e.s	18	--		
Manufactured, nitrogenous	150	--		
Gypsum and plaster	--	215	--	All to El Salvador.
Pigments, mineral: Natural, crude	159	--		
Salt and brine	1,937	15	--	All to Guatemala.
Stone, sand and gravel:				
Dimension stone, crude and partly worked	2	133	--	All to El Salvador.
Sand and gravel	--	1	--	All to Guatemala.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Distillate fuel oil 42-gallon barrels	--	233,252	--	All to Panama.
Lubricants do.	4,557	1,673	--	Guatemala 1,092; Nicaragua 581.
Residual fuel oil do.	126,360	--		

[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.

Table 9.—Honduras: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys, semimanufactures	676	757	246	Guatemala 136; Mexico 89.
Copper:				
Ore and concentrate	--	533	288	Mexico 239; West Germany 6.
Sulfate	231	156	155	West Germany 1.
Metal including alloys:				
Unwrought	58	1	1	
Semimanufactures	504	627	277	Peru 186; Japan 59.
Gold: Ore and concentrate and refined value, thousands	$34	--		

See footnote at end of table.

Table 9.—Honduras: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
METALS —Continued				
Iron and steel: Metal:				
Scrap	1	5	4	Guatemala 1.
Pig iron, cast iron, related materials	r1	--		
Ferroalloys	29	20	1	West Germany 19.
Steel, primary forms	4,773	5,515	5,267	Japan 136; West Germany 40.
Semimanufactures:				
Bars, rods, angles, shapes, sections	12,448	11,187	2,691	Brazil 2,050; Belgium-Luxembourg 1,660.
Universals, plates, sheets	17,901	12,683	2,112	France 6,763; Japan 3,523.
Hoop and strip	675	641	64	Austria 203; West Germany 133; Finland 115.
Rails and accessories	58	262	244	Netherlands 18.
Wire	8,971	12,176	414	Venezuela 4,439; Republic of South Africa 3,261; France 1,412.
Tubes, pipes, fittings	6,443	3,599	985	Guatemala 967; Costa Rica 693.
Castings and forgings, rough	1,532	604	32	Italy 548; Switzerland 17.
Lead: Metal including alloys:				
Unwrought	636	818	216	Mexico 600; Costa Rica 1.
Semimanufactures	21	11	6	West Germany 3; Guatemala 1.
Nickel: Metal including alloys:				
Unwrought kilograms	374	17	--	All from Mexico.
Semimanufactures	3	4	4	
Platinum-group metals: Metals including alloys, unwrought and partly wrought troy ounces	5,369	10,353	10,353	
Silver: Metal including alloys, unwrought and partly wrought do	3,665	48,097	2,604	Japan 45,011; West Germany 482.
Tin: Metal including alloys:				
Unwrought	21	23	22	Spain 1.
Semimanufactures	29	32	12	West Germany 8; Panama 7.
Zinc: Metal including alloys:				
Unwrought	1,086	1,084	21	Mexico 863; Canada 200.
Semimanufactures	169	371	23	Mexico 312; Peru 18.
Other:				
Ores and concentrates	545	--		
Base metals including alloys, all forms	7	10	8	France 2.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	4	(2)	(2)	
Grinding and polishing wheels and stones	69	59	3	Italy 36; West Germany 6.
Asbestos, crude	1,522	1,902	--	All from Canada.
Boron materials: Oxides and acids	3	4	1	West Germany 3.
Cement	2,104	1,255	26	West Germany 655; Denmark 551.
Clays, crude	5,489	1,724	1,336	Guatemala 357; Mexico 22.
Diamond: Industrial stones thousand carats	805	60	60	
Diatomite and other infusorial earth	305	398	251	Mexico 103; United Kingdom 41.
Fertilizer materials:				
Crude, n.e.s kilograms	961	8	--	All from Costa Rica.
Manufactured:				
Nitrogenous	50,302	63,848	15,707	Netherlands 24,356; West Germany 18,598.
Phosphatic	4,377	11,341	3,686	West Germany 6,015; Netherlands 1,640.
Potassic	5,845	9,728	1,775	West Germany 7,952; Guatemala 1.
Unspecified and mixed	15,563	14,053	155	Costa Rica 5,976; Japan 4,550; West Germany 2,010.
Graphite, natural	14	7	(3)	Mainly from Mexico.
Gypsum and plaster	32	39	34	West Germany 3; Guatemala 2.
Lime	31	15	--	All from United Kingdom.
Mica:				
Crude including splittings and waste kilograms	245	425	139	West Germany 139.
Worked including agglomerated splittings do	72	129	57	France 38; Netherlands 32.
Phosphates, crude do	370	208	208	
Pigments, mineral: Natural, crude	65	1	1	
Precious and semiprecious stones other than diamond: Natural value, thousands	$1	$3	--	West Germany $2; Switzerland $1.
Salt and brine	316	451	298	El Salvador 60; United Kingdom 54.

See footnotes at end of table.

Table 9.—Honduras: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sodium compounds, n.e.s.:				
Carbonate, manufactured	2,938	938	43	Belgium-Luxembourg 861; East Germany 20.
Sulfate, manufactured	2,886	2,838	201	Mexico 1,923; Belgium-Luxembourg 504.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	30	53	--	Guatemala 48; Costa Rica 5.
Worked	12	6	5	Guatemala 1.
Dolomite, chiefly refractory-grade	2	19	19	
Gravel and crushed rock	--	36	36	
Limestone other than dimension	95	51	--	Guatemala 46; Costa Rica 1.
Quartz and quartzite	214	287	226	West Germany 56; Netherlands 5.
Sand and gravel	24	36	36	
Sulfur:				
Elemental: Crude including native and byproduct	97	(2)	--	Mainly from West Germany.
Sulfuric acid	376	362	48	Netherlands 230; West Germany 84.
Talc, steatite, soapstone, pyrophyllite	281	154	117	Italy 20; Sweden 6.
Other: Crude	(3)	--		
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	56	58	1	West Germany 35; United Kingdom 22.
Coal: All grades including briquets	70	59	35	Belgium-Luxembourg 24.
Coke and semicoke	409	526	506	Colombia 20.
Petroleum:				
Crude, thousand 42-gallon barrels	2,721	1,415	--	Venezuela 1,089; Mexico 326.
Refinery products:				
Liquefied petroleum gas, do.	89	92	46	Mexico 46.
Gasoline, do.	510	265	2	Panama 94; Venezuela 73; Trinidad and Tobago 67.
Mineral jelly and wax, do.	12	10	2	West Germany 4; Japan 4.
Kerosene and jet fuel, do.	297	220	6	Panama 113; Trinidad and Tobago 70; Venezuela 16.
Distillate fuel oil, do.	1,170	591	24	Panama 215; Trinidad and Tobago 197; Venezuela 53.
Lubricants, do.	61	85	79	Jamaica 3; Netherlands Antilles 1.
Residual fuel oil, do.	(2)	--		

r Revised.
[1] Table prepared by H. D. Willis.
[2] Less than 1/2 unit.
[3] Revised to zero.

NICARAGUA

The Nicaraguan economy's 3% decline in 1987 followed upon a 3.5% decrease in 1986. Since 1984, the economy has shown a cumulative decline of approximately 9%. The GDP was $2.074 billion[7] in 1980 dollars. The balance of trade was a negative $492 million. Industrial production declined although petroleum products and industrial minerals showed gains of 5.6% and 6.6%, respectively, more than that of 1986.

The domestic mining industry has declined dramatically since its nationalization in 1979, and by 1987 accounted for only a fraction of the total GDP. Gold and silver made up the major portion of the total value of mineral production while cement, gypsum, lime, petroleum, refinery products, salt, and sand and gravel composed the remainder. The Government continued planning the revival of its mining industry, using financial and technical aid from Bulgaria, Sweden, the Soviet Union, and a number of Latin American countries.

Gold production for 1987 was almost 30,500 ounces compared with 28,700 ounces for 1986. Most of it was produced at the Francisco Meza Rojas Mine in the Province of Zelaya. The production target for 1987 was set at 39,000 ounces. Nicaragua produced about 28,600 ounces of silver in 1987.

In midyear, the Nicaraguan Mining Institute (INMINE) announced that an agreement had been signed by the Governments of Nicaragua and Czechoslovakia to reactivate the Siuna gold mine in Zelaya Province. Czechoslovakia is to deliver five 1,100-kilowatt electrical generating plants needed to restart mining operations that were halted in 1984. Mine operations resumed in September, and ore production began in December at the rate of 300 tons per day. Planned production was to be increased to 1,000 tons per day by 1989. The proved, probable, and possible reserves of gold and silver ore were estimated to be 26 million tons. Discussions with the U.S.S.R. were under way to reactivate the El Limón gold mine 40 kilometer northeast of Leon. In the past, El Limón accounted for 40% of Nicaragua's gold production.

In 1987, Nicaragua imported an estimated 5.5 million barrels of petroleum and petroleum products from the U.S.S.R. Exploration for oil and gas has been virtually nonexistent in recent years because of guerrilla activity, except for limited offshore surveys on the Caribbean shelf. Empresa Nacional de Luz y Fuerza (ENALUF) began the Momotombo Volcano geothermal project. The total potential of the geothermal field was estimated at 1,000 megawatts when fully operational. At yearend, the total installed electrical generating capacity of the country was 325 megawatts, which was 58% thermal, 31% hydro, and 11% geothermal. Actual production was 134 megawatts, or 41% of installed capacity. Nicaragua also purchased 30 megawatts of electrical energy from Honduras during the year.

PANAMA

In 1987, mineral production continued to be extremely limited and was primarily confined to that of clays, limestone, and sea salt.

The GDP expanded by an estimated 2.5% in 1987 to approximately $5.1 billion[8] in current dollars, slightly less than the 2.8% growth in 1986. Increased political strife continued to have a negative impact on development. However, continued growth in foreign trade boosted the importance of the Colón Free Zone and the Panama Canal in 1987.

Investigations of known deposits of coal, copper, gold, manganese, and silver continued during 1987. Of special interest were the vein and placer gold deposits occurring in the Provinces of Veraguas and Darién, the Cerro Colorado copper deposit in Chiriqui Province, and the Petaquilla copper deposits near Espinar. Exploratory drilling was carried out in alluvial gold deposits in the old gold mining district in the eastern region of Darién Province. New partners were being sought by the Panama Resource Development Co. as part of a joint venture to begin mining operations on the Petaquilla copper deposits.

The Transisthmian crude oil pipeline reported a decrease in activity. It will face further financial problems with the completion of the All America Pipeline that will extend from Santa Barbara, California, to McCamey, Texas, in the United States.

None of the exploratory wells drilled in the Gulf of Panama, a large sedimentary basin of Tertiary Age, yielded commercial quantities of natural gas or petroleum. Panama, lacking domestic production, imported in excess of 14 million barrels of petroleum, primarily from Mexico and Venezuela. The electric powerplants at Boyano and La Estrella became operational and produced 50% of total production in 1987.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Belizean dollars ($B) to U.S. dollars at the rate of $B2.00 = US$1.00.

[3]Where necessary, values have been converted from Costa Rican colones (c) to U.S. dollars at the average exchange rate of c62.78 = US$1.00.

[4]Where necessary, values have been converted from Salvadoran colones (c) to U.S. dollars at the rate of c5.00 = US$1.00.

[5]Where necessary, values have been converted from Guatemalan quetzals (Q) to U.S. dollars at the commercial or market rate of Q2.50 = US$1.00. The official exchange rate remained at Q1.00 = US$1.00 for previously contracted foreign debt. The interbank rate of Q2.70 = US$1.00 was established for remittances, tourism, and miscellaneous transactions.

[6]Where necessary, values have been converted from Honduran lempiras (L) to U.S. dollars at the rate of L2.00 = US$1.00.

[7]Where necessary, values have been converted from Nicaraguan cordobas (C$) to U.S. dollars at the official exchange rate of C$70.00 = US$1.00.

[8]Where necessary, values have been converted from Panamanian balboas (B) to U.S. dollars at the rate of B1.00 = US$1.00.

Table 10.—Panama: Exports and reexports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1984	1985	Destinations, 1985	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Unwrought	23	755	641	Japan 40; Mexico 20.
Semimanufactures	163	302	142	Costa Rica 115; Japan 21.
Copper:				
Matte and speiss including cement copper	--	111	75	Belgium-Luxembourg 18; West Germany 18.
Metal including alloys, unwrought	--	152	152	
Iron and steel: Metal:				
Scrap	4,040	1,771	--	Colombia 1,700; Costa Rica 71.
Steel, primary forms	16	--		
Semimanufactures: Universals, plates, sheets	--	1	--	All to Costa Rica.
Lead:				
Oxides	--	105	--	Ecuador 60; Costa Rica 45.
Metal including alloys, unwrought	--	163	--	Costa Rica 125; Ecuador 38.
Silver:				
Waste and sweepings value, thousands	--	$736	NA	NA.
Metal including alloys, unwrought and partly wrought troy ounces	18,261	--		
Zinc: Metal including alloys, semimanufactures	11	4	--	All to Nicaragua.
Other: Base metals including alloys, scrap	2,856	2,031	1,152	Belgium-Luxembourg 152; Ecuador 120.
INDUSTRIAL MINERALS				
Fertilizer materials: Manufactured, potassic value, thousands	--	$4	--	All to Bolivia.
Sodium compounds, n.e.s.: Sulfate, manufactured	--	58	--	Costa Rica 40; Ecuador 18.
Stone, sand and gravel: Dimension stone, worked	--	7	--	Mainly to Nicaragua.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	--	6,330	6,330	
Petroleum refinery products:				
Lubricants thousand 42-gallon barrels	3	4	--	Mainly to Costa Rica.
Unspecified do	204	731	148	Bahamas 326; United Kingdom 202.

NA Not available.
[1]Table prepared by H. D. Willis.

Table 11.—Panama: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	--	509	7	Italy 2; unspecified 500.
Metal including alloys:				
Unwrought	934	1,308	844	Saudi Arabia 267; West Germany 90.
Semimanufactures	983	1,098	418	Brazil 286; Costa Rica 132.
Cobalt: Oxides and hydroxides value, thousands	--	$3	--	All from West Germany.
Copper:				
Matte and speiss including cement copper	--	18	NA	NA.
Metal including alloys:				
Unwrought	--	6	1	Netherlands 3; Chile 2.
Semimanufactures	678	725	173	Chile 387; Belgium-Luxembourg 60.
Iron and steel: Metal:				
Scrap	--	4,938	100	France 2,512; Spain 2,000.
Pig iron, cast iron, related materials	--	8,095	3,521	Venezuela 4,000; Netherlands 500.
Ferromanganese	--	3	3	
Steel, primary forms	10,288	13,511	3,044	Venezuela 7,996; Costa Rica 1,325.

See footnotes at end of table.

Table 11.—Panama: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS —Continued				
Iron and steel: Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections	12,087	12,909	631	Brazil 2,417; Belgium-Luxembourg 1,782; Republic of Korea 1,298.
Universals, plates, sheets	33,201	33,060	873	Japan 15,174; France 5,496; Republic of Korea 3,949.
Hoop and strip	670	687	25	Japan 315; Republic of Korea 59.
Rails and accessories	--	126	114	Costa Rica 11; Italy 1.
Wire	7,175	3,730	208	Brazil 1,436; Republic of Korea 755; United Kingdom 379.
Tubes, pipes, fittings	9,155	3,960	654	France 1,019; Costa Rica 1,014; Republic of Korea 880.
Castings and forgings, rough	--	23	3	Costa Rica 20.
Lead:				
Oxides	--	19	--	Mexico 14; unspecified 5.
Metal including alloys:				
Unwrought	--	187	72	Costa Rica 115.
Semimanufactures	--	22	6	West Germany 11; Denmark 5.
Manganese: Oxides	--	1	1	
Nickel: Metal including alloys:				
Unwrought	--	2	NA	NA.
Semimanufactures	--	2	(2)	NA.
Rare-earth metals including alloys, all forms	--	3	1	Netherlands 2.
Silver:				
Waste and sweepings, value, thousands	--	$12	--	Guatemala $8; unspecified $4.
Metal including alloys, unwrought and partly wrought, do.	$489	$1,394	$367	Colombia $523; Guatemala $75.
Tin: Metal including alloys:				
Unwrought	--	15	(2)	Canada 10; Bolivia 1; West Germany 1.
Semimanufactures	--	2	1	West Germany 1.
Titanium: Oxides	--	149	--	Mexico 136; France 5; United Kingdom 3.
Uranium and thorium: Metals including alloys, all forms, value, thousands	--	$31	$11	Italy $5; France $1.
Zinc:				
Ore and concentrate, do.	--	$1	--	All from West Germany.
Oxides	--	53	44	Guatemala 4; Belgium-Luxembourg 3.
Metal including alloys:				
Unwrought	399	383	99	Peru 237; Canada 40.
Semimanufactures	--	18	9	Costa Rica 6; unspecified 3.
Other:				
Oxides and hydroxides	--	14	3	United Kingdom 11.
Ashes and residues	--	19	2	Costa Rica 12; unspecified 5.
Base metals including alloys, all forms	6	49	7	Italy 35; Spain 2.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	119	156	15	Brazil 27; Italy 26; Belgium-Luxembourg 25.
Asbestos, crude	--	224	--	Mainly from Canada.
Barite and witherite	--	718	--	All from Costa Rica.
Boron materials: Crude natural borates	--	1	1	
Cement	5,229	6,974	92	Costa Rica 2,487; Mexico 2,447; Republic of Korea 700.
Chalk	--	660	--	Mainly from Costa Rica.
Clays, crude	713	1,014	394	El Salvador 582; Colombia 18.
Diamond: Industrial stones, value, thousands	--	$3	--	All from Italy.
Diatomite and other infusorial earth	307	314	246	Mexico 68.
Feldspar, fluorspar, related materials	865	713	40	Guatemala 580; Canada 93.
Fertilizer materials:				
Crude, n.e.s	--	82	--	All from Guatemala.
Manufactured:				
Ammonia	157	25	20	West Germany 5.
Nitrogenous	24,693	20,067	4,066	Trinidad and Tobago 4,931; Czechoslovakia 2,950.
Phosphatic	2,978	7,614	7,363	Netherlands 249; Costa Rica 1.
Potassic	8,600	6,445	4,279	West Germany 2,016; Netherlands 149.
Unspecified and mixed	16,147	22,705	3,580	Costa Rica 8,534; West Germany 6,816.

See footnotes at end of table.

Table 11.—Panama: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Gypsum and plaster				
value, thousands	$373	$148	$76	Jamaica $66; Denmark $3.
Lime	695	375	364	NA.
Magnesium compounds: Magnesite, crude	--	70	65	Norway 5.
Mica: Worked including agglomerated splittings value, thousands	--	$4	$3	West Germany $1.
Nitrates, crude	--	2,492	26	Trinidad and Tobago 2,444; West Germany 22.
Phosphates, crude	--	23	--	All from Costa Rica.
Pigments, mineral: Iron oxides and hydroxides, processed	--	5	(2)	Mainly from West Germany.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	[3]$297	$312	$29	United Kingdom $156; Colombia $25.
Synthetic do	--	$5	$5	
Salt and brine	1,294	1,037	426	United Kingdom 194; Canada 190.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	1,941	2,116	1,664	West Germany 225; France 143.
Sulfate, manufactured	3,075	3,847	26	Mexico 3,500; Belgium-Luxembourg 121.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	905	498	17	Italy 431; Canada 40.
Worked	211	653	65	Italy 236; Spain 102; Mexico 71.
Gravel and crushed rock	--	57	50	Mexico 7.
Limestone other than dimension	--	1,186	--	All from Costa Rica.
Quartz and quartzite	--	7	4	Italy 3.
Sand other than metal-bearing	3,568	7,679	7,606	Netherlands 52; Mexico 7.
Sulfur:				
Elemental:				
Crude including native and by-product	--	21	12	Colombia 8; West Germany 1.
Colloidal precipitated, sublimed	--	15	3	West Germany 10; Italy 2.
Sulfuric acid	1,537	--	--	
Talc, steatite, soapstone, pyrophyllite	--	203	203	
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	--	35	17	France 18.
Coal: All grades excluding briquets	8,726	8,288	19	Colombia 8,269.
Coke and semicoke	--	46	42	West Germany 4.
Petroleum:				
Crude thousand 42-gallon barrels	10,317	8,988	49	Mexico 3,308; Ecuador 3,154; Venezuela 2,477.
Refinery products:				
Liquefied petroleum gas do	434	494	258	Netherlands Antilles 177; Venezuela 28.
Gasoline do	1,163	794	50	Venezuela 530; Trinidad and Tobago 131; Netherlands Antilles 71.
Mineral jelly and wax do	8	13	3	Japan 10.
Kerosene and jet fuel do	8	58	10	Netherlands Antilles 19; Venezuela 12.
Lubricants do	15	9	8	NA.
Residual fuel oil do	41	2	1	Netherlands Antilles 1.

NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Includes synthetic stones.

The Mineral Industry of Other Areas of the Far East and South Asia

By E. Chin, Gordon L. Kinney, Chin S. Kuo, and Travis Q. Lyday

CONTENTS

BANGLADESH[1]

Natural gas was Bangladesh's only significant exploited mineral. A few other minerals or mineral-based commodities were produced for local consumption. The most valuable were nitrogen fertilizer, salt, cement, and clay for brick.[2] The most important mineral industry development of 1987 was the start of modest production of crude oil, the first discovered and produced in the country.

PRODUCTION AND TRADE

Production of natural gas from the nation's huge reserves continued to increase but was limited by the lack of residential and industrial demand. Gas reserves of 7 trillion to 16 trillion cubic feet were sufficient for far more production than the country could efficiently utilize for many years. The country's consumption-to-reserves ratio was one of the lowest of the developing nations. Mineral exports have been insignificant, comprising a small amount of nitrogen fertilizer. Nitrogenous fertilizer exports could become important when planned new capacity comes onstream. Mineral imports were dominated by crude petroleum.

COMMODITY REVIEW

Industrial Minerals.—*Fertilizer Materials.*—Chittagong Urea Fertilizer Ltd. began commercial production at its new plant late in the year. The plant was constructed by Toyo Engineering Corp. of Japan and has a capacity of 330,000 tons per year of ammonia and 561,000 tons per year of urea (258,000 tons nitrogen content). Completion of the Chittagong plant brings Bangladesh's capacity to 1.6 million tons of urea per year from five natural-gas-based plants.

At yearend, Bangladesh began modest exports of bagged urea to Sri Lanka and East Africa. The shipments were part of a 90,000-ton commitment to local and international trading companies.

Two additional 561,000-ton-per-year urea

plants were in the planning stage, Karnaphuli Fertilizer Co. Ltd. at Chittagong and Jamuna Urea Fertilizer Ltd. at Jagannathganj, Jamalpur.[3]

Limestone.—The United Nations Development Program and the Asian Development Bank are planning a comprehensive survey of the country's limestone resources to establish enough new reserves to justify an increase in cement production capacity. Exploratory drilling will be conducted at four or five of the most promising sites in Sylhet and Sunamganj Districts. If enough cement quality limestone is confirmed, the Chhatak Cement Co. Ltd. and Surma Cement Co. plants would be expanded in the early 1990's.

Salt.—Bangladesh Government officials reportedly stopped importing salt because the nation became self-sufficient for the first time in 1986. Salt production was 150,000 tons higher than domestic demand in 1987. All salt was produced from seawater evaporation ponds.

Mineral Fuels.—*Coal.*—The Bangladesh Government continued planning the development of coal deposits discovered in 1985 in the Dinajpur and Rangpur Districts of the energy-poor northwest. A development proposal by The Broken Hill Pty. Co. Ltd. of Australia was being studied. The Government favored a production sharing agreement for the $500 million project, with the consortium responsible for all expenses. A considerable effort will still be necessary to delineate the reserves and engineering parameters. The coal would be used for electric power generation and by the brick industry.

Petroleum.—After the December 1986 oil discovery in the Haripur Gasfield of the Surma Basin by the Bangladesh Oil, Gas, and Mineral Corp. (BOGMC) the well was put into immediate production. The 300 to 400 barrels per day of waxy, low-sulfur crude was carried 20 kilometers by truck to Sylhet then 300 kilometers by rail to the refinery at Chittagong. To develop the field as rapidly as possible, Bangladesh Ministry of Energy officials signed a 25-year oil production sharing agreement with Scimitar Oil Ltd. in December. Under terms of the agreement Scimitar Oil was granted exclusive exploration and development rights in the Surma Basin. A minimum of three wells must be drilled during 1988-89. Scimitar Oil was allowed a 3- to 4-year cost recovery period at 40% of production for the first year and decreasing levels thereafter. After that, Scimitar Oil's share of production would decrease proportionally as production rises. At the maximum extraction rate, the Bangladesh Government would receive 90% of production. Scimitar Oil was solely responsible for the capital investment cost but may withdraw from the agreement without compensation if it determined there is insufficient oil.

In September, BOGMC reported a second oil discovery in the Surma Basin at Fenchuganj well No. 2. Oil was struck at a depth of 3,068 meters, below known natural gas horizons. The well tested 1,200 barrels per day of 17.2° API high wax, low-sulfur crude. Additional testing was under way to determine if the discovery was commercially exploitable.[4]

Oil from these fields should reduce Bangladesh's crude oil and refined product's import cost, which has been as much as $300 million annually.

The Bangladesh Shell Petroleum Development Co. was to begin its first drilling in Bangladesh early in 1988. This comes after 8 years of geophysical work interrupted by tribal hostilities. One well will be drilled near Shalbanhat, 10 kilometers from the Indian border and the second is planned for the Sitapahar area in the Chittagong Hills. Shell had been the only foreign oil operator working in Bangladesh before the Scimitar Oil negotiations.

The Government hoped to conclude additional oil exploration agreements following preparation of promotional packages by a consultant under a World Bank funded hydrocarbon habitat study. The promotional packages were nearly ready at yearend.

Table 1.—Other Areas of the Far East and South Asia: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Area and commodity	1983	1984	1985	1986[p]	1987[e]
BANGLADESH[2]					
Cement, hydraulic[3]	306,688	272,619	240,176	[e]292,000	310,000
Clays: Kaolin[3]	2,269	2,613	4,178	2,695	[4]12,272
Gas, natural, marketed[3 5] million cubic feet	70,133	80,257	90,958	101,138	[4]135,165
Iron and steel: Metal:[3]					
Steel, crude (ingot only)	47,401	73,387	101,419	95,514	[4]82,081
Steel products	54,552	100,741	126,582	111,593	[4]129,986
Nitrogen: N content of ammonia and ammonium sulfate	178,695	352,888	358,480	390,515	[4]435,900
Petroleum refinery products thousand 42-gallon barrels	7,168	7,958	7,357	7,405	7,610
Salt, marine[3]	243,091	671,832	489,000	[e]500,000	416,000
Stone: Limestone, industrial[3]	32,101	24,564	40,392	22,082	[4]41,660
BRUNEI[2]					
Gas, natural:					
Gross million cubic feet	352,000	[e]330,000	[e]330,000	[e]320,000	325,000
Marketed do.	[e]315,000	[e]300,000	307,645	284,565	300,000
Natural gas liquids:[e]					
Condensate thousand 42-gallon barrels	5,910	5,460	5,500	5,400	5,500
Natural gasoline do.	305	280	300	290	300
Liquefied petroleum gas do.	125	115	110	100	100
Total do.	6,340	5,855	5,910	5,790	5,900
Petroleum:					
Crude do.	63,875	58,560	54,300	59,860	56,000
Refinery products:					
Gasoline do.	553	605	600	[e]600	650
Distillate fuel oil do.	358	395	400	[e]400	450
Residual fuel oil do.	7	8	8	[e]10	10
Other including refinery fuel and losses do.	250	272	300	[e]300	350
Total do.	1,168	1,280	1,308	[e]1,310	1,460
CAMBODIA[e 2]					
Salt	40,000	40,000	40,000	40,000	40,000
CHRISTMAS ISLAND[2]					
Phosphate rock, marketable:					
Gross weight thousand tons	1,094	1,259	1,187	880	[4]842
P_2O_5 content do.	385	443	418	310	[4]296
HONG KONG[2]					
Cement, hydraulic do.	1,717	1,847	1,835	2,236	2,200
Clays:					
Kaolin	834	70	9,602	850	--
Other	51,272	92,293	82,446	68,737	[4]94,504
Feldspar	5,275	23,101	26,777	35,208	[4]22,853
Iron and steel: Metal: Steel, crude[e]	120,000	120,000	120,000	120,000	120,000
Quartz	--	34	116	33	--
NORTH KOREA[e 2]					
Aluminum metal ingot, primary	10,000	10,000	10,000	10,000	10,000
Cadmium metal, smelter	100	100	100	100	100
Cement, hydraulic thousand tons	8,000	8,000	8,000	8,000	9,000
Coal: Anthracite do.	36,000	36,000	36,000	[r]70,000	70,000
Coke do.	3,000	3,000	3,000	3,000	3,000
Copper:					
Mine output, Cu content	15,000	15,000	15,000	15,000	15,000
Metal:					
Smelter, primary and secondary	18,000	18,000	18,000	18,000	18,000
Refined, primary and secondary	22,000	22,000	22,000	22,000	22,000
Fluorspar	40,000	40,000	40,000	40,000	40,000
Gold, mine output, Au content troy ounces	160,000	160,000	160,000	160,000	160,000
Graphite	25,000	25,000	25,000	25,000	25,000
Iron and steel:					
Iron ore and concentrate, marketable:					
Gross weight thousand tons	8,000	8,000	8,000	[r]8,500	8,500
Fe content do.	3,200	3,200	3,200	[r]3,400	3,400
Metal:					
Pig iron do.	5,500	5,750	5,750	5,750	5,800
Ferroalloys, furnace type unspecified do.	120	120	120	120	120
Steel, crude do.	6,100	6,500	6,500	[r]4,500	4,500

See footnotes at end of table.

Table 1.—Other Areas of the Far East and South Asia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Area and commodity	1983	1984	1985	1986[p]	1987[e]
NORTH KOREA[e 2] —Continued					
Lead:					
Mine output, Pb content	75,000	110,000	110,000	110,000	110,000
Metal, primary and secondary	60,000	95,000	95,000	95,000	95,000
Magnesite, crude thousand tons	1,900	1,900	1,900	1,900	1,500
Nitrogen: N content of ammonia do	450	450	450	450	450
Phosphate rock	500,000	500,000	500,000	500,000	500,000
Salt, all types	570,000	570,000	570,000	570,000	570,000
Silver, mine output, Ag content thousand troy ounces	1,600	1,600	1,600	1,600	1,600
Sulfur thousand tons	230	230	230	230	230
Talc, soapstone, pyrophyllite	170,000	170,000	170,000	170,000	170,000
Tungsten, mine output, W content	500	1,000	1,000	1,000	1,000
Zinc:					
Mine output, Zn content	140,000	140,000	180,000	180,000	225,000
Metal, primary	120,000	120,000	180,000	180,000	210,000
LAOS[e 2]					
Cement (from imported clinker)	--	--	[4]2,500	4,000	4,500
Gypsum	70,000	[4]82,000	110,000	130,000	70,000
Salt, rock	10,000	[4]8,000	10,000	30,000	13,000
Tin, mine output, Sn content	359	430	[4]540	550	450
MONGOLIA[2]					
Cement, hydraulic thousand tons	165	141	151	[e]200	200
Coal:					
Anthracite and bituminous do	408	458	480	[e]500	500
Lignite and brown do	4,566	4,973	6,038	[e]6,200	6,300
Total do	4,974	5,431	6,518	[e]6,700	6,800
Copper, mine output, Cu content	104,000	[e]118,000	[e]128,000	[e]136,000	136,000
Fluorspar, all grades thousand tons	708	747	787	[e]790	800
Gypsum[e] do	32	32	32	32	32
Lime, hydrated and quicklime[e] do	93	95	95	95	95
Molybdenum, mine output, Mo content[e]	960	1,000	1,000	1,100	1,100
Petroleum refinery products:[e]					
Kerosene thousand 42-gallon barrels	23	23	23	23	23
Residual fuel oil do	20	20	20	20	20
Salt[e]	16,000	16,000	16,000	16,000	16,000
Tin, mine output, Sn content[e]	1,000	1,000	1,000	1,000	1,000
Tungsten, mine output, W content[e]	1,500	1,500	1,500	1,500	1,500
NEPAL[6]					
Cement, hydraulic	45,587	39,225	31,479	92,853	[4]151,631
Clays for cement manufacture	[e]2,000	[e]2,000	4,242	6,798	10,000
Coal: Lignite	8,244	7,595	6,808	4,536	[4]5,081
Copper ore:					
Gross weight	11	[e]9	6	[e]6	6
Cu content	4	[e]3	2	[e]2	[4]2
Gem stones:					
Garnet kilograms	[e]23,000	[e]20,000	27,300	[e]25,000	25,000
Tourmaline do	[e]10	[e]12	60	[e]50	50
Lime, agricultural	[e]10,000	7,000	7,000	584	500
Magnesite, crude	15,016	14,603	19,851	63,190	[4]38,388
Salt	6	700	7,500	[e]7,000	7
Stone:					
Limestone	50,422	[e]45,000	55,953	174,798	[4]334,270
Marble:					
Chips	482	609	700	[e]700	[4]11,644
Cut square meters	3,208	[e]3,000	7,641	10,442	[4]15,847
Craggy do	3,530	708	691	3,590	[4]6,168
Talc	15,263	7,595	6,015	[e]7,000	[4]3,539
SINGAPORE[2]					
Cement, hydraulic thousand tons	3,153	2,821	1,992	1,805	[4]1,527
Iron and steel: Metal: Steel, crude[e] do	350	350	350	350	350
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	19,738	17,731	[e]18,000	[e]18,000	19,000
Jet fuel do	30,690	43,578	[e]44,000	[e]44,000	44,000
Kerosene do	31,377	14,338	[e]14,000	[e]13,000	13,000
Distillate fuel oil do	88,258	76,677	[e]77,000	[e]75,000	72,000
Residual fuel oil do	81,906	87,418	[e]87,000	[e]85,000	82,000
Lubricants do	3,852	3,959	[e]4,000	[e]4,000	4,000
Other do	41,663	45,560	[e]46,000	[e]45,000	45,000
Refinery fuel and losses do	8,536	4,024	[e]4,000	[e]3,000	3,000
Total do	306,020	293,285	[e]294,000	[e]287,000	282,000

See footnotes at end of table.

Table 1.—Other Areas of the Far East and South Asia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Area and commodity	1983	1984	1985	1986[p]	1987[e]
SINGAPORE[2] —Continued					
Stone: Granite, broken thousand cubic meters	7,569	7,422	6,743	5,565	[4]7,319
Sulfur, byproduct of petroleum	3,666	5,557	[e]6,000	[e]5,000	5,000
SRI LANKA					
Cement, hydraulic thousand tons	[4]506	500	600	600	600
Clays:					
Ball clay	11,980	16,500	23,825	20,470	[4]20,210
Kaolin	7,976	11,100	5,405	6,260	[4]6,869
Brick and tile clay[e]	60,000	70,000	70,000	[4]40,000	60,000
Clays for cement manufacture	51,931	[e]50,000	39,123	36,322	[4]23,277
Feldspar, crude and ground	2,609	5,200	9,789	7,270	[4]7,442
Gem stones, precious and semiprecious, other than diamond value, thousands	$39,814	$20,569	[e]$20,000	$23,304	[4]$13,196
Graphite, all grades	5,528	5,623	7,413	7,453	9,400
Iron and steel: Metal: Semimanufactures	24,546	15,990	9,310	10,872	[4]33,508
Mica, scrap[e]	[4]171	200	200	200	200
Nitrogen: N content of ammonia[e]	[4]62,700	70,000	30,000	--	--
Petroleum refinery products:[e]					
Gasoline thousand 42-gallon barrels	[4]806	1,100	1,100	1,100	1,100
Jet fuel do.	[4]517	700	700	700	700
Kerosene do.	[4]1,047	1,400	1,400	1,400	1,400
Distillate fuel oil do.	[4]3,703	5,000	5,000	5,000	5,000
Residual fuel oil do.	[4]3,235	4,350	4,350	4,500	4,500
Other do.	[4]1,252	1,650	1,650	1,500	1,500
Refinery fuel and losses[e] do.	600	800	800	800	800
Total do.	11,160	15,000	15,000	15,000	15,000
Phosphate rock	[e]16,000	13,685	[e]14,000	14,977	20,600
Rare-earth metals: Monazite concentrate, gross weight[e]	300	[4]147	200	200	200
Salt	129,222	107,000	76,858	104,278	[4]115,274
Stone:					
Limestone thousand tons	947	[e]1,000	[e]1,000	649	[4]2,044
Quartz, massive	764	1,100	1,566	1,090	[4]1,090
Titanium concentrate, gross weight:					
Ilmenite	81,778	102,048	114,854	129,907	[4]128,500
Rutile	8,093	6,467	8,558	8,443	[4]7,200
Zirconium: Zircon concentrate, gross weight	5,721	3,708	4,061	[e]4,000	4,000
VIETNAM[7]					
Bauxite: Gross weight[e]	3,000	5,000	6,000	6,000	6,000
Cement, hydraulic[e] thousand tons	[4]928	1,100	1,300	1,540	[4]1,512
Chromium: Chromite[e]	16,000	16,000	15,000	15,000	15,000
Clays: Kaolin[e]	1,200	1,000	1,000	1,000	1,000
Coal: Anthracite thousand tons	6,019	5,840	6,200	6,007	[4]6,500
Gypsum[e]	25,000	25,000	25,000	25,000	25,000
Iron and steel: Metal:[e]					
Steel, ingot thousand tons	100	100	110	110	110
Steel, rolled do.	40	40	50	50	50
Nitrogen: N content of ammonia	([8])	([8])	([8])	([8])	([8])
Petroleum: Crude[e] thousand 42-gallon barrels	--	--	--	200	600
Phosphate rock:[e]					
Gross weight thousand tons	200	200	[4]516	530	300
P_2O_5 content do.	66	66	170	175	105
Salt do.	890	[e]800	379	[e]450	229
Tin:[e]					
Mine output, Sn content	550	500	600	650	680
Metal, smelter	520	475	570	620	645
Zinc:[e]					
Mine output, Zn content	7,000	7,000	5,000	5,000	5,000
Metal, smelter, primary	6,000	6,000	4,200	4,200	4,200

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

[1]Table includes data available through Aug. 24, 1988.

[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 information is inadequate to make reliable estimates of output levels.

[3]Data are for year ending June 30 of that stated.

[4]Reported figure.

[5]Gross production is not reported; the quantity vented, flared, or reinjected is believed to be negligible.

[6]Data are for the Nepalese fiscal year ending mid-July of that stated.

[7]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 and natural gas are not available, and no basis is available to make reliable estimates of output levels.

[8]Nitrogen (N content of ammonia) production capacity of the country's only known plant is 54,000 tons per year; it is not known at what output level the plant is operating.

BRUNEI[5]

Brunei's oil-rich history dates from the turn of this century. Bruneians had long been using oil seeps to obtain fuel for lamps, and in 1899, the first well was drilled near the capital in an area of oil seeps. The well was unsuccessful but a number of companies continued to explore for oil until 1918. By that time, only Anglo-Saxon Petroleum Co., a subsidiary of Royal Dutch Petroleum Co. of the Netherlands, remained. The present Royal Dutch subsidiary is incorporated in Brunei as Brunei Shell Petroleum Co. Ltd. Brunei Shell's continuing exploration work finally paid off with the discovery of the giant Seria Oilfield in 1929. Brunei became an oil exporter in 1932. Seria Oilfield production, which peaked at 115,000 barrels per day in 1956, passed the 1-billion-barrel mark in 1982. It continued to produce at yearend at 30,000 barrels per day.

The petroleum sector dominated the nation's economy, and the sector in turn was dominated by Brunei Shell, the only operating oil company in Brunei through 1986. Brunei Shell held the most extensive oil concessions but three other companies have exploration rights. These are Sunray Oil Co. (a subsidiary of Mobil Oil Corp. of the United States), Woods Petroleum Corp. of the United States, and Jasra Petroleum Sdn. Bhd. (Jaspet), of Brunei which formed a joint venture at yearend 1986 with Elf Aquitaine Offshore BV Asia, a subsidiary of Société Nationale Elf Aquitaine S.A. (Elf) of France.

Petroleum's contribution to the economy has declined somewhat in recent years because of the planned reduction in crude oil output and lower world oil and gas prices. In 1980, 83% of the gross domestic product (GDP) in 1980 prices was attributed to oil and gas. By 1985, the figure dropped to 65%, still dominating the economy.

The petroleum industry element of the GDP actually understates its domination in Brunei. The Government, the largest employer, relied almost entirely on petroleum income to pay its expenses. Much of the construction sector depended on contracts from Brunei Shell for petroleum-related work such as housing for petroleum workers and other infrastructure for producing, and transporting oil and gas. Many of the service sector merchants relied on oil operations for sales of tools, equipment, and parts.[6]

Electric power demand had been increasing steadily since 1974, when 211 million kilowatt-hours were supplied by an installed capacity of 81,000 kilowatts. By 1985, demand had risen to 906 million kilowatt-hours while the generating capacity was 268,000 kilowatts. Early in 1987, the Government inaugurated a cogeneration plant at Lumut with seven 21-megawatt gas turbine generators, each coupled to a waste-heat boiler for steam generation for the adjacent Brunei liquefied natural gas (LNG) plant. The $148 million powerplant[7] was a joint venture between the Government's Brunei Directorate of Electric Services and two of Brunei Shell's operating companies. The new plant is to supply the anticipated electricity needs of the country through the end of the century.

Petroleum production and trade have been intimately related in the Brunei economy because of the high percentage of production that is exported. Since 1981, 99% of Brunei's foreign-exchange earnings came from exports of oil and LNG. The value of petroleum exports has varied owing to world prices, mainly, and production levels. Exports of refined petroleum products reached a low in 1984 at $17 million and a peak of $275 million in 1980. The value of LNG varied from a low of $534 million in 1977 to a high of $1,618 million in 1981 while annual production remained nearly constant at 5 million tons during the past decade. The biggest earner every year has been crude oil. Sales of crude oil varied from a low of $1,156 million in 1976 to a high of $2,090 million in 1980. Since 1980, the value has declined steadily as a result of a Government-planned gradual reduction of output to conserve its petroleum.

Brunei Shell planned to drill two exploration wells during 1987 and Jaspet-Elf planned to begin drilling an offshore exploratory hole in November and another during 1988. An onshore well, started in 1986, was drilled near Jerudong and completed early in 1987. The well was believed to have produced a noncommercial amount of gas in a very complex geologic structure.

Seismic surveying continued both onshore and offshore. Onshore, 40 line-kilometers were completed in the Lahi and Jerudong areas. Offshore, 445 line-kilometers were surveyed west of the Cham-

pion Field, 71 line-kilometers in the Magpie Field, and 750 line-kilometers in the area between the Southwest Ampa and Magpie Fields.

Subject to Government of Brunei approval, a new company, Union Texas Brunei Ltd. was to have been formed in 1987 by Union Texas Petroleum Co. of Houston, Texas, to explore, reportedly, a 971-square-kilometer oil-and-gas concession. Union Texas was working with two partners, Woods Petroleum Corp. and OPUBCO International Ltd., the latter a subsidiary of Oklahoma Publishing Co. of Oklahoma City, Oklahoma.[8]

CAMBODIA[9]

The Cambodian mineral industry made no significant contribution to the economy of the country during 1987. Small amounts of brick, ceramics, lime, phosphate rock, and salt were produced for local consumption and in some cases provincewide consumption. A small cement grinding plant of a few tons per day capacity was believed to be in operation near Kampot using imported clinker. Colored gem stones had been mined in the Pailin area of Battambang Province, but because of unstable political conditions in the area, officials had discouraged the mining for the last few years.

There were no known mineral exports during the year. The major mineral import was a modest amount of petroleum products. Cement clinker, fertilizer materials, and steel semimanufactures were generally imported in amounts totalling a few hundred tons per year.

The second conference on geological cooperation was held during March by representatives from Cambodia, Laos, and Vietnam. One result of the conference was an agreement by the countries to coordinate in making a geological map on a scale of 1:1,000,000 by the end of the year. In addition, they will continue a survey of mineral deposits at the frontier areas of the three countries, to be finished in 1989.

The industrial sector, never a major part of the Cambodian economy, was destroyed during the 1970's. With major assistance from the U.S.S.R. and Vietnam, about 60 establishments were restored.[10] Only a few of these were related to minerals. One was a reinforced-concrete-products plant with a capacity of 2,000 cubic meters per year. The Soviet Union assisted with the reconstruction of the plant, which will make slabs, panels, and beams for the country's rudimentary construction industry.

Another plant reportedly restored during the year was a small phosphate fertilizer factory at Touk Meas in Kampot Province. The plant was a grinding and roasting facility for locally dug phosphate rock. The treatment increased the solubility of the phosphate, thereby increasing its effectiveness on annual crops, but it did not require the high technology and large capital investment of a superphosphate plant.

The only known production of metal during the year was the recovery of scrap from the many damaged weapons and war materiel left from the years of military conflict. A small crude smelter melted aluminum, brass, and possibly steel scrap to cast into pots and utensils for domestic use.

Under an agreement signed in May, Vietnamese officials agreed to help Cambodia in the transportation of fuel, to expand a 6,500-cubic-meter fuel-storage facility near Phnom Penh, and to build a small "oil refinery."[11] Considering that Cambodia has no domestic crude oil production, and that Vietnam itself has no oil refineries as yet, the intent of the aid agreement probably was to set up a small used-motor-oil recovery and cleaning plant for the recycling of expensive vehicle lubricants.

CHRISTMAS ISLAND[12]

Since 1987, Guano-based phosphate rock has been the mainstay of the economy of the Territory of Christmas Island, an island south of Java, Indonesia, in the Indian Ocean. The island has been a territory of Australia since October 1, 1958. The phosphate operations were owned and operated by Phosphate Mining Co. of Christmas Island, a wholly Australian Government-owned firm headquartered in Perth.

Although the Christmas Island deposit has traditionally been one of two principal sources of phosphate rock for Australia, the Australian Government suspended operations at the mine in November following intense industrial disputes, low productivity levels, and continued deteriorating profitability during the year. In addition to closure, the Government announced that the mine's infrastructure would be demolished.

The Government also cited the steady exhaustion of high-grade phosphate reserves and the drain on the Australian treasury of the islanders themselves as reasons for closing the mine. The Government had been subsidizing housing rents, as well as electricity and water for the mine.

Near yearend, the Union of Christmas Island Workers commissioned a consulting firm to assess the feasibility of reopening the mine through private operation. However, the Government had already announced that no further erosion of the island's rain forest region, where most of the remaining high-grade reserves were located, would be permitted.

Table 2.—Christmas Island: Exports of phosphate rock, by destination

(Thousand metric tons)

Destination	1985	1986	1987
Australia	499.0	489.9	358.8
Indonesia	37.9	18.2	39.7
Japan	39.4	41.3	15.0
Korea, Republic of	44.7	22.3	9.3
Malaysia	230.9	196.2	253.8
New Zealand	326.9	107.1	164.9
Philippines	2.0	--	--
Sri Lanka	--	1.1	--
Taiwan	6.2	3.7	5.4
Other	--	.3	--
Total	1,187.1	880.1	846.9

Source: Phosphate Rock Statistics 1987, International Fertilizer Industry Association Ltd.

HONG KONG[13]

At the end of 1987, there was only one mining lease, one mining license, and one prospecting license registered with the Mines Division of Hong Kong's Labour Department. The only extant mining operations were those for the extraction of small amounts of clays and feldspar. The Mines Division also controls the possession, conveyance, storage, manufacture and use of explosives in Hong Kong. During the year, 4,773 tons of explosives was consumed in blasting for civil construction projects. In addition, transit storage was provided for explosives imported from the United States and France for use by companies conducting offshore oil drilling in the South China Sea.

Hong Kong's economy is virtually trade-oriented, importing raw materials for processing into finished products for export. The domestic industry is based on light manufacturing. Textiles and clothing constitute the largest industry, accounting for 41% of the value of domestic exports and 43% of the industrial work force. Electronics is the second-largest export earner followed by watches and clocks, which displaced toys as the third-largest export-earner.

The value of total imports in 1987 was $50.7 billion; total exports were valued at $48.7 billion.[14] Hong Kong was the 10th-largest trading partner of the United States in 1987. Exports to the United States were valued at $13.5 billion while U.S. exports to Hong Kong totaled $4.1 billion. About 25% of the value of Hong Kong's total trade is made up of goods shipped to and received from China.

Table 3.—Hong Kong: Exports and reexports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	16,566	19,987	--	Taiwan 15,277; Indonesia 2,416; Republic of Korea 2,294.
Oxides and hydroxides	64,161	681	--	China 632; Philippines 29.
Metal including alloys:				
Scrap	18,423	22,080	--	Japan 20,695; China 622.
Unwrought	48,903	26,085	--	Thailand 9,535; China 5,173; Taiwan 4,648.
Semimanufactures	46,145	29,531	3,007	China 16,728; Taiwan 2,892.
Arsenic: Oxides and acids	81	308	39	China 216; Indonesia 45.
Chromium: Oxides and hydroxides	76	387	--	West Germany 90; Republic of Korea 82; North Korea 42.
Cobalt: Oxides and hydroxides	29	31	--	Vietnam 10; Taiwan 6; Republic of Korea 6.

See footnotes at end of table.

Table 3.—Hong Kong: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Copper:				
Oxides and hydroxides	37	150	--	China 144.
Sulfate	51	72	--	Burma 25; Indonesia 21; China 15.
Metal including alloys:				
Scrap	24,444	27,947	--	Japan 11,902; Taiwan 7,083; Republic of Korea 3,308.
Unwrought	4,001	1,630	(2)	China 670; Republic of Korea 432; Taiwan 413.
Semimanufactures	5,594	9,576	125	China 5,843; Taiwan 1,589; Singapore 737.
Gold:				
Waste and sweepings value, thousands	$3,665	$23,919	$491	Switzerland $11,440; West Germany $6,464; United Kingdom $3,952.
Metal including alloys, unwrought and partly wrought thousand troy ounces	68	1,542	75	United Kingdom 1,039; Switzerland 161; West Germany 139.
Iron and steel: Metal:				
Scrap	319,137	275,389	322	Taiwan 149,779; Indonesia 69,276; Japan 40,505.
Pig iron, cast iron, related materials	2,156	133	--	Fiji 62; China 53; Philippines 18.
Ferroalloys:				
Ferromanganese	500	496	--	North Korea 495.
Ferrosilicon	--	3,483	--	Republic of Korea 1,626; Taiwan 1,197; Indonesia 292.
Unspecified	563	1,662	--	North Korea 822; Netherlands 601; Republic of Korea 140.
Steel, primary forms	41,920	24,842	--	China 19,839; Taiwan 4,971.
Semimanufactures:				
Bars, rods, angles, shapes, sections	834,999	456,109	3	China 421,807; Macau 18,014; Singapore 7,277.
Universals, plates, sheets	71,177	187,525	--	China 172,600; Macau 4,037; Taiwan 3,562.
Hoop and strip	5,712	14,260	--	China 11,188; Taiwan 1,738; Philippines 358.
Rails and accessories	45	231	--	Singapore 117; China 114.
Wire	9,352	13,732	9	China 12,075; Macau 679.
Tubes, pipes, fittings	41,938	42,906	64	China 39,254; Macau 2,065.
Castings and forgings, rough	9	11	--	All to Taiwan.
Lead:				
Oxides	33	54	--	Indonesia 30; Pakistan 12; North Korea 10.
Metal including alloys:				
Scrap	1,883	2,502	--	Taiwan 1,366; China 1,101.
Unwrought	345	435	--	China 378; Vietnam 50.
Semimanufactures	56	269	--	Philippines 204; China 42.
Magnesium: Metal including alloys, all forms	44	418	--	China 366.
Manganese:				
Ore and concentrate	120	200	--	Indonesia 113; Republic of Korea 60.
Oxides	618	1,213	2	Indonesia 434; Republic of Korea 249; Vietnam 144.
Mercury 76-pound flasks	1,237	2,719	1,190	Indonesia 825; Australia 454.
Nickel:				
Oxides and hydroxides	244	162	--	Taiwan 147; Republic of Korea 7.
Metal including alloys:				
Scrap	118	387	--	Japan 358.
Unwrought	3,242	4,865	--	Taiwan 3,131; North Korea 637; Republic of Korea 481.
Semimanufactures	1,081	376	--	Taiwan 171; Republic of Korea 121; China 47.
Platinum-group metals:				
Waste and sweepings value, thousands	$451	$4,168	$1,935	United Kingdom $1,051; West Germany $591.
Metals including alloys, unwrought and partly wrought troy ounces	26,645	19,905	2,577	United Kingdom 7,249; Japan 3,595; China 2,837.
Silver:				
Waste and sweepings value, thousands	$71,890	$22,641	--	France $11,133; United Kingdom $8,473; West Germany $3,024.
Metal including alloys, unwrought and partly wrought thousand troy ounces	611	1,284	--	Japan 586; Thailand 270; China 183.

See footnotes at end of table.

Table 3.—Hong Kong: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Tin:				
Ore and concentrate	4,768	3,709	191	Singapore 864; Malaysia 647; Republic of Korea 602.
Metal including alloys:				
Scrap	90	24	13	United Kingdom 10.
Unwrought	5,570	1,943	271	Japan 827; Taiwan 349.
Semimanufactures	648	747	--	Taiwan 303; China 167; Singapore 134.
Titanium: Oxides	2,743	2,840	136	China 829; India 662; Vietnam 245.
Tungsten:				
Ore and concentrate	1,717	2,013	--	U.S.S.R. 1,415; North Korea 403; Netherlands 145.
Metal including alloys, all forms	2	5	--	Netherlands 3; China 2.
Uranium and/or thorium: Oxides and other compounds kilograms	4,340	8,081	--	Republic of Korea 6,000; China 2,000.
Zinc:				
Oxides	393	835	--	Vietnam 528; Indonesia 191; China 39.
Blue powder	172	51	--	All to China.
Metal including alloys:				
Scrap	78	33	--	Do.
Unwrought	4,496	31,245	3,147	Republic of Korea 9,850; China 8,089; Macau 3,555.
Semimanufactures	86	223	--	China 179; Indonesia 39.
Other:				
Ores and concentrates	8,270	9,389	927	Republic of Korea 4,376; China 1,802; Taiwan 1,279.
Ashes and residues	10	473	--	Taiwan 216; China 166; India 46.
Base metals including alloys, all forms	6,537	5,495	605	Netherlands 2,044; China 809; Japan 440.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	1,409	2,773	--	Indonesia 700; China 667; Macau 467.
Artificial:				
Corundum	9,011	18,117	734	Taiwan 7,547; Republic of Korea 6,621; Japan 2,258.
Silicon carbide	1,210	1,919	55	Taiwan 701; Republic of Korea 600; Japan 439.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$87	$592	--	Belgium-Luxembourg $400; China $186.
Grinding and polishing wheels and stones	3,099	3,213	144	Indonesia 2,112; China 312.
Asbestos, crude	155	21	--	Republic of Korea 16; Indonesia 5.
Barite and witherite	16	120	--	All to Republic of Korea.
Boron materials: Oxides and acids	306	312	--	Republic of South Africa 145; Republic of Korea 85; North Korea 79.
Bromine and fluorine	--	22	--	All to North Korea.
Cement	738,876	901,687	--	China 534,143; Macau 364,716.
Clays, crude	97,898	120,431	--	Taiwan 94,855; Republic of Korea 18,696; Indonesia 2,338.
Diamond:				
Gem, not set or strung carats	540,141	500,091	132,133	Belgium-Luxembourg 147,188; Israel 77,139.
Industrial stones do	157,507	357,939	--	China 128,562; Netherlands 110,122.
Diatomite and other infusorial earth	254	442	--	China 417; India 15.
Feldspar, fluorspar, related materials	38,571	50,555	--	Taiwan 41,985; Indonesia 7,180; Republic of Korea 890.
Fertilizer materials:				
Crude, n.e.s	393	800	--	China 642; United Arab Emirates 158.
Manufactured:				
Ammonia	12	47	--	All to China.
Nitrogenous	51,079	2,448	--	China 2,354.
Potassic	1,904	--	--	
Unspecified and mixed	1,574	6,488	6	China 5,490; Malaysia 830.
Graphite, natural	508	3,036	--	Republic of Korea 2,508; France 200; Taiwan 191.
Gypsum and plaster	7,307	4,709	1	Macau 3,510; Indonesia 565; China 430.
Iodine	910	2	--	Mainly to North Korea.
Lime	114	47	--	All to China.

See footnotes at end of table.

Table 3.—Hong Kong: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Magnesium compounds:				
Magnesite, crude	15,444	28,167	--	Taiwan 20,740; Indonesia 6,368; Republic of Korea 1,001.
Oxides and hydroxides	12	1,311	--	Taiwan 815; Republic of Korea 438; China 32.
Meerschaum, amber, jet kilogram	57	--		
Mica:				
Crude including splittings and waste	8	6	--	Taiwan 3; Republic of South Africa 2.
Worked including agglomerated splittings	83	83	--	China 69; Republic of South Africa 4.
Pigments, mineral:				
Natural, crude	517	970	--	Indonesia 788; Taiwan 57; Japan 52.
Iron oxides and hydroxides, processed	2,138	3,037	--	Indonesia 1,154; China 663; United Kingdom 363.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$78,806	$106,213	$25,364	Japan $44,114; China $11,198.
Synthetic do	$659	$705	$216	China $120; France $108.
Salt and brine	1,039	947	--	China 666; Papua New Guinea 84; Thailand 82.
Sodium compounds, n.e.s.:				
Carbonate, natural and manufactured	585,296	378,118	--	China 377,713.
Sulfate, natural and manufactured	5,366	12,729	--	Indonesia 7,457; Vietnam 3,124; Republic of Korea 871.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	4,413	6,380	35	Taiwan 4,324; Indonesia 451.
Worked	11,366	10,989	185	China 9,507; Macau 545; Malaysia 314.
Dolomite, chiefly refractory-grade	36	36	--	All to China.
Gravel and crushed rock	4,842	1,413	--	China 916; Taiwan 374.
Limestone other than dimension	19,284	1,261	--	All to China.
Quartz and quartzite	1,491	1,183	--	Taiwan 540; Sudan 230; Bangladesh 120.
Sand other than metal-bearing	1,833	639	--	Macau 337; China 233.
Sulfur:				
Elemental:				
Crude including native and byproduct	31	5,066	--	Indonesia 5,054.
Colloidal, precipitated, sublimed	25	96	--	Indonesia 50; Vietnam 20; Philippines 17.
Sulfuric acid	228	64	--	China 56; Vietnam 5.
Talc, steatite, soapstone, pyrophyllite	13,471	29,250	--	Indonesia 20,548; Taiwan 4,406; Republic of Korea 2,998.
Other:				
Crude	1,015	1,441	42	Taiwan 1,095; China 289.
Slag and dross, not metal-bearing	5,957	359	--	Republic of Korea 200; China 62; Taiwan 60.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	18	21	--	All to China.
Carbon black	8,586	3,446	--	China 2,073; North Korea 633; Indonesia 427.
Coal: Anthracite	5	10	--	All to Brunei.
Coke and semicoke	337	500	--	Indonesia 488.
Petroleum refinery products thousand 42-gallon barrels	1,854	6,101	(2)	China 4,394; Macau 1,294.

[1]Table prepared by Audrey D. Wilkes.
[2]Less than 1/2 unit.

Table 4.—Hong Kong: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	18,773	20,526	20	China 20,481.
Oxides and hydroxides	32,818	57	--	Japan 35; Belgium-Luxembourg 7; China 4.
Metal including alloys:				
Scrap	888	1,301	65	Macau 664; China 229.
Unwrought	76,071	46,950	591	Canada 18,791; Australia 7,724; North Korea 6,675.
Semimanufactures	74,422	58,870	879	Taiwan 16,810; Japan 7,796; Republic of Korea 7,148.
Arsenic: Oxides and acids	99	116	--	All from China.
Chromium: Oxides and hydroxides	513	747	23	China 381; West Germany 278.
Cobalt: Oxides and hydroxides	19	48	--	United Kingdom 25; China 12; West Germany 10.
Copper:				
Oxides and hydroxides	156	288	18	West Germany 169; Norway 95.
Sulfate	271	373	6	France 115; China 83; Thailand 56.
Metal including alloys:				
Scrap	9,148	6,784	2,299	China 1,998; Vietnam 1,175; Singapore 741.
Unwrought	5,391	2,357	726	Republic of South Africa 428; North Korea 226.
Semimanufactures	54,191	70,247	3,551	Japan 27,122; Taiwan 9,937; China 9,444.
Gold:				
Waste and sweepings value, thousands	$383	$587	$1	Malaysia $529; China $31.
Metal including alloys, unwrought and partly wrought thousand troy ounces	5,229	1,648	2	Switzerland 998; China 324; Australia 152.
Iron and steel: Metal:				
Scrap	20,093	33,669	10,919	Canada 7,826; Macau 6,752; China 3,170.
Pig iron, cast iron, related materials	4,891	4,316	21	North Korea 3,558; France 286.
Ferroalloys:				
Ferromanganese	1,848	1,998	--	Republic of South Africa 1,005; Netherlands 506; Norway 485.
Ferrosilicon	1,690	4,677	--	China 3,833; Republic of South Africa 610.
Unspecified	1,547	3,220	--	Republic of South Africa 1,542; China 933; Australia 655.
Steel, primary forms	147,722	173,778	--	Republic of South Africa 100,624; Spain 29,831; West Germany 14,781.
Semimanufactures thousand tons	2,300	2,444	44	Japan 749; Republic of South Africa 415; China 205.
Lead:				
Oxides	143	168	(2)	China 90; West Germany 41; Belgium-Luxembourg 11.
Metal including alloys:				
Scrap	458	681	--	China 164; Australia 157; Singapore 118.
Unwrought	2,321	5,071	--	U.S.S.R. 2,499; Taiwan 1,238; China 693.
Semimanufactures	244	213	1	Republic of South Africa 79; China 45; United Kingdom 33.
Magnesium: Metal including alloys, all forms	44	396	268	Norway 69; Japan 50.
Manganese:				
Ore and concentrate	243	341	--	All from China.
Oxides	885	1,455	--	China 1,196; Japan 250.
Mercury 76-pound flasks	2,834	3,586	--	China 3,425; Spain 87.
Molybdenum: Metal including alloys, all forms kilograms	108	126	--	All from Austria.
Nickel:				
Oxides and hydroxides	273	199	--	Canada 164; China 18.
Metal including alloys:				
Unwrought	3,812	7,053	55	Canada 3,361; Norway 1,777; Finland 510.
Semimanufactures	1,460	327	65	Canada 128; Japan 42.

See footnotes at end of table.

Table 4.—Hong Kong: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Platinum-group metals:				
Waste and sweepings value, thousands	--	$8	--	All from Taiwan.
Metals including alloys, unwrought and partly wrought troy ounces	43,964	18,895	19	United Kingdom 12,499; Australia 2,860; Switzerland 1,789.
Silver:				
Waste and sweepings value, thousands	$112	$39	--	All from Philippines.
Metal including alloys, unwrought and partly wrought thousand troy ounces	1,390	1,904	33	Australia 690; Japan 568; United Kingdom 200.
Tin:				
Ore and concentrate	6,100	1,755	--	All from China.
Metal including alloys:				
Scrap	61	35	--	Malaysia 29; China 5.
Unwrought	3,982	3,568	24	China 2,613; Singapore 374; Malaysia 320.
Semimanufactures	882	634	16	China 323; Singapore 127; Japan 77.
Titanium: Oxides	7,492	8,283	861	China 2,009 Australia 1,574; United Kingdom 1,487.
Tungsten:				
Ore and concentrate	3,799	3,626	--	China 3,457.
Metal including alloys, all forms	--	1	--	All from China.
Uranium and/or thorium: Oxides and other compounds	27	22	2	France 16; Japan 2.
Zinc:				
Oxides	699	1,171	20	China 786; France 144; Canada 90.
Blue powder	84	17	--	West Germany 6; United Kingdom 5; Singapore 2.
Metal including alloys:				
Scrap	178	539	33	Macau 449; China 57.
Unwrought	32,713	70,262	32	China 34,987; Australia 15,698; Belgium-Luxembourg 6,693.
Semimanufactures	575	710	5	West Germany 214; Belgium-Luxembourg 142; Republic of Korea 72.
Other:				
Ores and concentrates	8,830	8,301	--	China 8,196.
Oxides and hydroxides	2,950	2,594	(2)	China 2,511.
Ashes and residues	4,710	5,914	--	China 5,878.
Base metals including alloys, all forms	5,705	7,026	268	China 5,656; Singapore 248; Philippines 239.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	10,321	27,672	374	Indonesia 13,747; Japan 6,596; China 6,240.
Artificial:				
Corundum	10,777	18,710	91	China 18,019; Japan 419.
Silicon carbide	1,279	1,765	(3)	China 1,713; Taiwan 24.
Dust and powder of precious and semi-precious stones including diamond value, thousands	$28	$97	$17	Ireland $27; Belgium-Luxembourg $22.
Grinding and polishing wheels and stones	4,796	4,062	62	China 2,558; Japan 803; Taiwan 380.
Asbestos, crude	168	82	--	All from China.
Barite and witherite	227	425	--	China 274; Thailand 126.
Boron materials: Oxides and acids	544	559	245	China 230; U.S.S.R. 84.
Bromine and fluorine	58	44	--	Mainly from Italy.
Cement thousand tons	3,460	4,131	--	Japan 1,918; Taiwan 1,109; Republic of Korea 740.
Chalk	8	--		
Clays, crude	113,092	144,294	1,217	China 116,961; Macau 19,380.
Cryolite and chiolite	4	5	--	All from Denmark.
Diamond:				
Gem, not set or strung thousand carats	1,434	2,091	105	India 912; Israel 504; Belgium-Luxembourg 311.
Industrial stones do	234	427	17	Netherlands 267; China 73; Ireland 46.
Diatomite and other infusorial earth	602	984	984	

See footnotes at end of table.

Table 4.—Hong Kong: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Feldspar, fluorspar, related materials	23,989	37,396	--	All from China.
Fertilizer materials:				
Crude, n.e.s	715	812	--	Canada 314; Netherlands 304; China 106.
Manufactured:				
Ammonia	1,611	2,045	--	China 1,863; Netherlands 88; United Kingdom 41.
Nitrogenous	66,515	6,735	2	China 2,173; Japan 1,803; Republic of Korea 960.
Potassic	15,000	--	--	
Unspecified and mixed	9,509	14,265	77	Belgium-Luxembourg 5,269; West Germany 4,378; Republic of Korea 3,430.
Graphite, natural	1,499	3,685	--	All from China.
Gypsum and plaster	103,210	110,865	168	Thailand 69,377; Japan 36,629.
Iodine kilograms	550	1,500	1,000	West Germany 250; Japan 250.
Lime	42,715	44,588	--	China 43,825; Japan 718.
Magnesium compounds:				
Magnesite, crude	19,798	29,791	--	China 29,334.
Oxides and hydroxides	1,533	1,710	--	Japan 1,310; China 338.
Meerschaum, amber, jet kilograms	600	--		
Mica:				
Crude including splittings and waste	32	48	--	United Kingdom 43; India 5.
Worked including agglomerated splittings	819	1,022	13	Japan 382; Belgium-Luxembourg 343; France 221.
Pigments, mineral:				
Natural, crude	461	940	--	China 932.
Iron oxides and hydroxides, processed	3,618	5,288	1,065	China 2,406; Japan 809.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$61,378	$77,271	$12,775	Thailand $21,093; India $6,159; China $4,142.
Synthetic do	$2,014	$2,699	$665	Japan $375; Thailand $342.
Salt and brine	106,599	130,537	6	China 119,012; West Germany 4,803.
Sodium compounds, n.e.s.:				
Carbonate, natural and manufactured	594,463	414,020	371,394	East Germany 17,751; Poland 8,451.
Sulfate, natural and manufactured	29,140	45,878	6	China 44,388; Taiwan 1,386.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	6,433	13,644	--	China 13,002.
Worked	27,439	35,084	12	Italy 24,657; China 3,091; Spain 2,535.
Dolomite, chiefly refractory-grade	356	201	--	United Kingdom 165; Norway 36.
Gravel and crushed rock thousand tons	3,401	4,849	(2)	China 4,590; Macau 251.
Limestone other than dimension	26,042	38,448	--	China 38,124.
Quartz and quartzite	2,924	8,243	--	China 8,088.
Sand other than metal-bearing thousand tons	1,108	1,273	(2)	China 1,271.
Sulfur:				
Elemental:				
Crude including native and by-product	530	5,342	10	China 5,242.
Colloidal, precipitated, sublimed	58	294	--	West Germany 255; Netherlands 20; Taiwan 18.
Dioxide	200	19	19	
Sulfuric acid	5,858	6,613	59	China 6,473; United Kingdom 40.
Talc, steatite, soapstone, pyrophyllite	15,972	32,707	172	China 32,172.
Other:				
Crude	3,043	6,997	607	China 6,114.
Slag and dross, not metal-bearing	649	1,116	--	China 921; Thailand 169.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	108	59	17	Spain 36; Singapore 6.
Carbon black	9,181	3,281	120	Republic of Korea 2,075; China 643.
Coal: Anthracite and bituminous thousand tons	5,523	6,393	(2)	Republic of South Africa 2,524; Australia 2,417; China 1,078.

See footnotes at end of table.

Table 4.—Hong Kong: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coke and semicoke	4,288	3,860	--	China 2,671; Japan 638; Taiwan 551.
Petroleum refinery products thousand 42-gallon barrels	37,724	47,594	1,734	Singapore 33,423; China 8,380.

[1]Table prepared by Audrey D. Wilkes.
[2]Less than 1/2 unit.

NORTH KOREA[15]

The Government began its ambitious third 7-year plan (1987-93). The plan called for an annual growth of 8% in gross national product (GNP). Judging from the 3% GNP growth in 1985 and 1986, it was highly unlikely that the goal was achieved in 1987 because industrial production, for example, would have had to increase much more than available capacity. In general, the country's plants, machinery, and infrastructure were old and inefficient. It was relying on massive aid from China and the U.S.S.R. for technology and capital to fulfill the plan's output targets. North Korea has had a trade deficit for several years, accumulating a foreign debt of more than $3 billion.[16] In August, European creditor banks threatened to freeze the country's bank assets in London, including gold bullion, if North Korea refused to service bank loans of $850 million plus interest, unpaid since 1984. Major imports were flour, machinery, crude oil, and wheat while principal exports consisted of minerals, metals, and rice. During the third 7-year plan, massive exports were targeted for cement; magnesia clinker; nonferrous metals, mainly lead and zinc; and rolled steel. The country had a trade agreement with India, exchanging its zinc for India's wheat. Proposals of broader trade were being negotiated for supplying steel plate, sulfur, and urea to India in return for agrochemicals, mica, and mining machinery. North Korea imported steam coal from China and the U.S.S.R. and coking coal from Australia. It exported barite to the U.S.S.R. and magnesia to the European Economic Community. The steel production target was 10 million tons in 1987 compared with 9 million tons in 1986, despite the fact that the country's annual capacity was only 7.5 million tons. Expansion of the Kim Chaek iron and steel complex, the country's largest integrated steel plant, increase steel production by 480,000 tons. During the third plan, the output capacity was to be further expanded from 2 million to 4 million tons. Plant expansion and process innovation at the Hwanghae iron and steel complex boosted steel production by 70,000 tons. The capacity of the Kangson steel plant was doubled to 1.4 million tons per year. The Nampo steel plant is to be expanded from 1 million to 3 million tons per year. Iron ore production in 1987 was 8.5 million tons from reserves estimated to be 3.3 billion tons. To meet increased steel production, new iron ore mines were opened at Tokonsong and Sohaeri. Mechanization and commissioning of a powerplant at the Musan Mine, North Korea's largest iron ore mine, helped to increase production by 614,000 tons. Its capacity was expanded from 5.5 million to 6.5 million tons per year. During the third 7-year plan, production of nonferrous metals, notably copper, lead, and zinc, was to be more than 1.7 million tons of metal per year from mines and plants in the Komdok, Tanchon, and Yanggang Districts. However, production of metals in terms of gross weight of ore for 1987 from these districts was only 700,000 tons. North Korea's lead and zinc ore reserves are estimated at 6 million and 12 million tons, respectively. The production of lead and zinc contained in ore was 110,000 tons and 225,000 tons, respectively. At the Komdok mining complex, the dressing capacity of lead and zinc ore was rated at 10 million tons per year. The country's copper ore reserves are estimated to be 2.2 million tons. However, most of the feed for the country's copper smelter came from imports of Peruvian copper concentrates. The out-

put of aluminum was also to increase in the 7-year plan due to the planned installation of a new aluminum smelter. The Government and North Korean business executives in Tokyo planned to reopen the Unsan gold mine, 100 kilometers north of Pyongyang, which originally began production in 1896. Production was expected to be 32,000 troy ounces of gold per year by yearend 1988 and 321,000 ounces within a decade from an investment of $55 million. North Korea intended to repay the Japanese creditors with gold.

In the industrial mineral sector, North Korea was the largest producer of magnesite in the world. Kanjo Province has large deposits of high-grade magnesite and an annual production of 1.5 million tons. The processing plant at the Tanchon magnesia complex was expanded and the first-stage construction was completed in 1987. Construction of the Sariwon potassic fertilizer complex with innovative technology was under way. The ore feed for the complex will come from a potassic feldspar mine being developed in the Chongdan District. Annual cement capacity was 12 million tons in 1987, and the target in the third 7-year plan was to increase output to 22 million tons per year by 1993. Most of the increase in capacity was to come from new installations at Sariwon and Kaechon. Cement output was 9 million tons in 1987. The Sunchon cement complex, with a capacity of 3 million tons per year, was to be modernized and expanded in 1988. The country's only indigenous energy sources were coal and hydropower. Coal reserves are estimated to be 11.9 billion tons. Coal production in North Korea increased to 70 million tons in 1986 and 1987. Production was expected to rise to 120 million tons per year by 1993. The Kukdong and Yangjong coal mines produced more than 1 million tons of metallurgical coal. Five of 10 planned new pits at Anju in western North Korea, 60 kilometers north of Pyongyang, completed development in 1987. Construction of the Sosa and Soho surface mines at Anju was also completed. In the Districts of Sunchon, Takchon, Pukchang, and Kangdong, other pits were to be modernized and expanded to increase coal production. A new 750,000-kilowatt power station at Taichuan was under construction on the Datong River. Ten other hydropower dams were built previously on this river.

Table 5.—North Korea: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal destinations, 1986
METALS			
Aluminum: Metal including alloys, all forms	8,715	11,474	Hong Kong 6,675; Japan 3,632.
Copper: Metal including alloys, all forms	[2]1,107	940	Japan 611; Hong Kong 226.
Gold: Metal including alloys, unwrought and partly wrought, troy ounces	133,715	NA	
Iron and steel: Metal:			
Scrap	2,520	25,160	All to Japan.
Pig iron, cast iron, related materials	74,127	73,206	Japan 69,648; Hong Kong 3,558.
Ferroalloys	3,765	4,298	U.S.S.R. 3,040; Japan 1,258.
Steel, primary forms	115,865	107,873	Japan 61,868; Thailand 26,178.
Semimanufactures:			
Bars, rods, angles, shapes, sections	10,645	68	Singapore 44; France 24.
Universals, plates, sheets	33,127	39,286	Japan 18,322; Hong Kong 16,110.
Hoop and strip	--	62	All to Singapore.
Rails and accessories	16	--	
Tubes, pipes, fittings	515	163	France 107; Singapore 51.
Castings and forgings, rough	2	--	
Lead: Metal including alloys, all forms	8,769	15,325	Japan 7,890; West Germany 6,833.
Magnesium: Metal including alloys, all forms	--	20	All to Japan.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, value, thousands	--	$1,828	All to West Germany.
Silver: Metal including alloys, unwrought and partly wrought, do.	$96	$8,664	West Germany $8,607; Thailand $57.
Zinc:			
Ore and concentrate	11,843	11,033	All to Japan.
Oxides	10	--	
Metal including alloys, all forms	33,631	41,643	Japan 39,054; Hong Kong 2,457.
Other:			
Ores and concentrates	--	10	All to Japan.
Ashes and residues	([3])	3,331	Japan 3,311.
Base metals including alloys, all forms	29	15	All to Singapore.

See footnotes at end of table.

Table 5.—North Korea: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal destinations, 1986
INDUSTRIAL MINERALS			
Cement	263,000	20	All to Barbados.
Clays, crude	10,579	9,122	All to Japan.
Feldspar	--	880	Do.
Fertilizer materials: Manufactured:			
Nitrogenous	3,096	--	
Potassic	15,000	--	
Unspecified and mixed	13,937	--	
Graphite, natural	5,798	4,560	Japan 4,306; Poland 195.
Magnesium compounds, unspecified	[4]168,935	194,163	Poland 92,652; West Germany 42,820; Japan 33,007.
Precious and semiprecious stones other than diamond: Natural and synthetic value, thousands	$11	$101	Italy $91; Hong Kong $8.
Stone, sand and gravel:			
Dimension stone, all forms	6,662	8,457	All to Japan.
Gravel and crushed rock	299	494	Do.
Quartz and quartzite	([5])	--	
Talc, steatite, soapstone, pyrophyllite	20,430	23,800	Japan 14,383; Poland 9,417.
Other: Crude	([6])	701	All to Japan.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	100	165	All to Thailand.
Coal, all grades including briquets	259,138	405,609	All to Japan.
Petroleum refinery products:			
Kerosene and jet fuel 42-gallon barrels	--	442	All to Hungary.
Residual fuel oil do	94,938	--	

[p]Preliminary. NA Not available.

[1]Table prepared by Audrey D. Wilkes. Owing to a lack of official trade data published by North Korea, this table should not be taken as a complete presentation of this country's mineral exports. These data have been compiled from United Nations information and data published by the trading partner countries. The United States did not report any imports of mineral commodities from North Korea during 1986.

[2]Excludes unreported quantity valued at $942,000 imported by Japan.

[3]Unreported quantity valued at $397,000 imported by Japan.

[4]Excludes unreported quantity valued at $6,770,000 imported by Japan.

[5]Unreported quantity valued at $148,000 imported by Japan.

[6]Unreported quantity valued at $45,000 imported by Japan.

Table 6.—North Korea: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal sources, 1986
METALS			
Alkali and alkaline-earth metals	[2]1	([3])	All from Japan.
Aluminum:			
Oxides and hydroxides	28,208	11,539	Japan 11,521.
Metal including alloys:			
Unwrought	6,473	--	
Semimanufactures	1,315	--	
Chromium:			
Ore and concentrate	16,000	25,000	All from U.S.S.R.
Oxides and hydroxides	66	64	Hong Kong 42; Japan 22.
Cobalt: Oxides and hydroxides	2	3	Mainly from Hong Kong.
Columbium and tantalum: Metal including alloys, all forms, tantalum kilograms	4,000	386	All from Japan.
Copper:			
Ore and concentrate	4,443	1,149	Do.
Metal including alloys:			
Scrap	18	798	Do.
Unwrought	1,198	500	Chile 498.
Semimanufactures	226	84	Japan 63; Hong Kong 13.
Gold:			
Contained in copper ore and concentrate value, thousands	$239	--	
Metal including alloys, unwrought and partly wrought do	--	$7	All from Japan.

See footnotes at end of table.

Table 6.—North Korea: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal sources, 1986
METALS —Continued			
Iron and steel: Metal:			
Ferroalloys:			
Ferromanganese	7,506	843	Hong Kong 495; Japan 348.
Unspecified	681	1,922	Hong Kong 822; Japan 596; France 504.
Semimanufactures:			
Bars, rods, angles, shapes, sections	513	478	Japan 278; Sweden 144.
Universals, plates, sheets	5,076	3,486	Japan 1,852; France 752; West Germany 442.
Hoop and strip	117	434	Japan 355; Hong Kong 41.
Rails and accessories	6,758	1,687	All from Japan.
Wire	2,070	104	Japan 73; Hong Kong 29.
Tubes, pipes, fittings	8,326	3,794	Japan 1,933; Spain 1,179.
Castings and forgings, rough	--	1	All from Japan.
Lead:			
Ore and concentrate	7,935	2,375	All from Thailand.
Oxides	--	10	All from Hong Kong.
Metal including alloys, unwrought	3,047	6,491	All from Japan.
Magnesium: Metal including alloys, all forms	193	68	West Germany 32; Japan 20.
Manganese:			
Ore and concentrate	21,320	30,000	All from U.S.S.R.
Oxides	54	168	Japan 148.
Mercury 76-pound flasks	290	145	All from Singapore.
Molybdenum: Metal including alloys, all forms	1,000	--	
Nickel: Metal including alloys:			
Unwrought	660	637	All from Hong Kong.
Semimanufactures	261	2	Austria 1; Japan 1.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$169	$520	Japan $215; United Kingdom $158; West Germany $147.
Silver: Metal including alloys, unwrought and partly wrought do	--	$75	Japan $64; Australia $11.
Tin:			
Ore and concentrate	3	20	All from Hong Kong.
Oxides	--	2	All from Japan.
Metal including alloys:			
Unwrought	194	247	Hong Kong 123; Singapore 123.
Semimanufactures	3	(3)	All from Japan.
Titanium:			
Oxides	56	34	Japan 21; Singapore 10.
Metal including alloys, all forms	--	18	All from Japan.
Tungsten:			
Ore and concentrate	149	488	Hong Kong 403; Singapore 85.
Metal including alloys, all forms	4	1	All from Japan.
Zinc:			
Oxides	--	6	Do.
Metal including alloys, all forms	50	47	Do.
Other:			
Ores and concentrates	103	12,579	Australia 10,777; Hong Kong 1,802.
Oxides and hydroxides	132	--	
Base metals including alloys, all forms	264	74	Singapore 35; Hong Kong 20; Japan 18.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc	--	47	All from Italy.
Artificial: Corundum	--	58	Japan 40; Hungary 18.
Dust and powder of precious and semiprecious stones excluding diamond value, thousands	$9	$14	All from Japan.
Grinding and polishing wheels and stones	(3)	28	Japan 22; Hong Kong 6.
Boron materials: Oxides and acids	66	79	All from Hong Kong.
Bromine including iodine and fluorine	--	24	Japan 22.
Cement	1	15	All from Singapore.
Clays, crude	--	14	Do.
Diamond:			
Gem, not set or strung value, thousands	--	$150	All from Belgium-Luxembourg.
Industrial stones do	$134	$30	Switzerland $22; Japan $8.
Fertilizer materials:			
Crude, n.e.s	--	298	All from Japan.
Manufactured:			
Phosphatic	--	12	Do.
Potassic	99,100	23,000	All from U.S.S.R.
Unspecified and mixed	--	513	All from Japan.
Gypsum and plaster	23,312	23,000	All from Thailand.
Magnesium compounds: Magnesite, crude	--	36	All from Singapore.
Phosphates, crude	21,250	--	
Phosphorus, elemental	--	20	All from Japan.

See footnotes at end of table.

Table 6.—North Korea: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal sources, 1986
INDUSTRIAL MINERALS —Continued			
Pigments, mineral: Iron oxides and hydroxides, processed	(3)	--	
Potassium salts, crude	11,000	--	
Precious and semiprecious stones other than diamond:			
Natural value, thousands	--	$23	West Germany $10; Japan $8.
Synthetic do	$34	$20	Singapore $12; West Germany $8.
Salt and brine	329	296	All from Japan.
Sodium compounds, n.e.s	613	--	
Stone, sand and gravel:			
Dimension stone, all forms	1,355	1,207	Italy 1,128.
Quartz and quartzite	--	12	All from West Germany.
Sulfur:			
Elemental, all forms	23,200	14,000	All from Poland.
Sulfuric acid	2	--	
Other: Crude	4	142	Japan 92; Singapore 32.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	14	988	Hong Kong 633; Singapore 350.
Coal, all grades including briquets	103,416	128,380	All from Australia.
Coke and semicoke	38,660	104,490	Poland 88,000; Japan 16,490.
Peat including briquets and litter	221	--	
Petroleum refinery products:			
Gasoline 42-gallon barrels	3,485	274	Singapore 255.
Mineral jelly and wax do	3,566	1,866	Japan 1,078; Hong Kong 394.
Kerosene and jet fuel do	496	352	All from Japan.
Distillate fuel oil do	455	90	All from Hong Kong.
Lubricants do	2,001	26,463	Singapore 22,470; Japan 3,693.
Residual fuel oil do	33	372,020	Singapore 371,435.
Bitumen and other residues do	--	18,659	All from Singapore.
Petroleum coke do	8,283	--	

[p]Preliminary.

[1]Table prepared by Audrey D. Wilkes. Owing to a lack of official trade data published by North Korea, this table should not be taken as a complete presentation of this country's mineral imports. These data have been compiled from United Nations information and data published by the trading partner countries. The United States did not report any exports of mineral commodities to North Korea during 1986.

[2]Excludes unreported quantity valued at $3,000 exported by Japan.

[3]Less than 1/2 unit.

LAOS[17]

Laos was one of the world's poorest countries, with an estimated 1987 per capita GDP of $140. The country contained only the beginning of an infrastructure. There were no railroads; the highway and telecommunications network was rudimentary, and only a small portion of the country had dependable electricity. Subsistence agriculture was the main occupation of most Lao people.

The mineral industry contributed very little to the economy. The most important mineral exports were gypsum and tin. The major foreign exchange earner was the sale of electric power to Thailand. The landlocked country of 3.5 million people was closely allied with the Soviet Union and Vietnam and relied heavily on foreign aid for its economic survival. Foreign aid contributions were estimated at about $150 million in each of the last few years. The list of principal donors included Australia, Japan, the Soviet Union, Sweden, and the United Nations. During the last few years the aid has been mainly for agricultural development and basic infrastructure. The resource and mineral-related aid was for expanding the Nam Ngum hydroelectric plant, developing the gypsum mine at Dong Heng in Savannakhet Province, and modernizing tin mining at Phon Tiou and Bo Neng in Khammouan Province.

Economic growth has improved recently, at least partly, because of a new economic management policy geared to decentralizing decisionmaking and relying more on market incentives. Industrial production increased as did overall trade. The trade deficit, however, also increased substantially during 1987. Inflation, which rose 65% in 1985 and 100% in 1986, declined to a much more tolerable increase of 25% in 1987.

Although mineral exploitation was minimal, the potential for significant develop-

ment was quite impressive. The Lao press reported an abundance of resources available to the nation and listed energy resources such as anthracite coal in Vientiane, Phong Saly, Luang Prabang, and Saravane Provinces; lignite in Xieng Khouang and Louang Namtha Provinces; and petroleum possibilities in the Savannakhet Plain. The article continued by describing the nonfuel minerals delineated during the last few years. There is hematite at Pha Yuan Mountain and magnetite at Pha Lek Mountain, both in Xieng Khouang Province. The Pha Lek magnetite deposit reportedly contains 1 billion tons of ore of more than 70% iron content. A potash deposit near Vientiane is a continuation of extensive potash deposits across the border in Thailand. Limestone is readily available throughout the country but major deposits were in Khammouan, Luang Prabang, and Vientiane Provinces. Also, reported for the first time, was a "glass mining factory"[18] at Houaisai in Bokeo Province. The reference presumably refers to a glass sand quarry and possibly a glass factory as well. Salt occurs in several provinces, but the most important salt mining operations were in Vientiane Province, with smaller mines in Savannakhet, Oudomsai and Phong Saly Provinces. In addition, bauxite, gold, lead, and zinc deposits have been discovered, but their estimated reserves have not been reported.

Table 7.—Laos: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal destinations, 1986
Aluminum: Metal including alloys, scrap	--	69	All to Thailand.
Copper: Metal including alloys, scrap	5	10	Do.
Iron and steel: Metal: Semimanufactures	158	--	
Zinc: Metal including alloys, scrap	6	--	

[p]Preliminary.

[1]Table prepared by Audrey D. Wilkes. Owing to a lack of official trade data published by Laos, this table should not be taken as a complete presentation of this country's mineral exports. These data have been compiled from United Nations information and data published by the trading partner countries. The United States did not report any imports of mineral commodities from Laos during 1986.

Table 8.—Laos: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal sources, 1986
METALS			
Aluminum: Metal including alloys, all forms	1	3	All from Thailand.
Copper: Metal including alloys, all forms	20	1	Do.
Iron and steel: Metal:			
Ferroalloys:			
Silicon metal kilograms	130	--	
Unspecified	--	1	Do.
Steel, primary forms	--	2	Do.
Semimanufactures:			
Bars, rods, angles, shapes, sections	2,094	896	Do.
Universals, plates, sheets	4,807	5,138	Japan 5,130.
Wire	56	493	All from Thailand.
Tubes, pipes, fittings	201	586	Japan 378; Thailand 208.
Castings and forgings, rough	1	--	
Lead: Metal including alloys, all forms	2	(2)	All from Thailand.
Silver: Metal including alloys, unwrought and partly wrought value, thousands	--	$1	Do.
Tin:			
Oxides	--	3	Do.
Metal including alloys, all forms	1	--	
Zinc: Metal including alloys, all forms	189	750	Do.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.: Grinding and polishing wheels and stones	1	2	Do.
Cement	6,176	10,350	Do.
Chalk	(3)	--	
Clays, crude	6	--	
Fertilizer materials: Manufactured:			
Ammonia	2	5	Do.
Nitrogenous	3,950	850	Thailand 800; Japan 50.
Unspecified and mixed	150	250	Thailand 200; Japan 50.
Precious and semiprecious stones other than diamond: Natural kilograms	62	--	

See footnotes at end of table.

Table 8.—Laos: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal sources, 1986
INDUSTRIAL MINERALS —Continued			
Salt and brine	158	97	All from Thailand.
Sodium compounds, n.e.s.:			
Carbonate, natural and manufactured	--	27	Do.
Sulfate, natural and manufactured	386	--	
Stone, sand and gravel:			
Dimension stone, worked	30	13	All from Thailand.
Limestone other than dimension	68	--	
Sand other than metal-bearing	--	8	Do.
Sulfur:			
Elemental: Colloidal, precipitated, sublimed	--	3	Do.
Sulfuric acid	1	18	Do.
Talc, steatite, soapstone, pyrophyllite	--	63	All from Norway.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	([3])	2	All from Thailand.
Coke and semicoke	--	3	Do.
Petroleum refinery products:			
Liquefied petroleum gas 42-gallon barrels	2	12	Do.
Gasoline do.	84,269	--	
Kerosene and jet fuel do.	62,132	--	
Distillate fuel oil do.	122,568	--	
Lubricants do.	8,717	56	Do.
Bitumen and other residues do.	12,490	--	

[p]Preliminary.

[1]Table prepared by Audrey D. Wilkes. Owing to a lack of official trade data published by Laos, this table should not be taken as a complete presentation of this country's mineral imports. These data have been compiled from United Nations information and data published by the trading partner countries. The United States did not report any exports of mineral commodities to Laos during 1986.

[2]Unreported quantity valued at $1,000.

[3]Less than 1/2 unit.

MONGOLIA[19]

The mineral industry of Mongolia was an important part of its economy. Of the 12 minerals produced, coal, copper, fluorspar, and molybdenum were of particular importance. Copper, fluorspar, and molybdenum accounted for more than 35% of its exports during 1987.

The Government completed, at yearend, a major restructuring of its industrial management, condensing several agencies to increase efficiency and eliminate duplication of functions. The changes were part of Mongolia's effort to modernize its ailing economy and reduce its large trade deficit. In all, eight ministries or commissions were abolished and five new ones were formed. Those disbanded and pertinent to the mineral industry were the Ministry of Geological and Mining Industry and the Ministry of Fuel and Power Industry. The new ministries were the Ministry of Power, Mining, and Geological Industry and the Ministry of Natural Environmental Protection.

Environmental problems have become of such importance that they were placed at the Ministerial level. Dozens of years of uncontrolled lumbering on the Taal River watershed have increased the runoff and erosion and altered the flow characteristics of the river. This, in turn, has created a severe water shortage in Ulaanbaatar. Restoration of the forests in the upper reaches of the Taal River will be a primary task of the new ministry.

The economy grew 3.5% over that of 1986, as measured by the change in national income, and industrial production increased 4.7% over 1986. In recent years the industrial sector continued to gain in importance, providing 40% of national income and having a labor force twice as large as that of agriculture. Most of the sector's value was derived from the mineral industry.

A joint Soviet-Mongolian exploration team discovered a zeolite deposit in Mongolia. Zeolites are hydrated aluminum silicates of the alkali metals. Their unusual chemical properties make them valuable in various water treatment processes, odor control, and as a desiccant in industrial chemical reactions.

Additional copper-molybdenum deposits have been discovered adjacent to the Erdenet complex. Geologists believe the new deposits could double existing reserves.

Mongolia's trade was dominated by the U.S.S.R. and other member countries of the Council for Mutual Economic Assistance

(CMEA), which accounted for 96%. Its major exports were copper, fluorite, and molybdenum concentrates going to the U.S.S.R. The expansion of the Erdenet Mine to 20 million tons of ore per year should increase copper-molybdenum exports greater relative importance by 1990.

COMMODITY REVIEW

Metals.—Fifth-phase construction of the Erdenet complex got under way during the year. The joint Soviet-Mongolian copper-molybdenum mine was being modernized, and the mining capacity was being increased from 16 million to 20 million tons per year. Finland's Outokumpu Oy was negotiating with Erdenet for the modernization of the ore treatment plant in return for copper concentrate. Under the proposed barter arrangement, Outokumpu would take either 20,000 tons per year for 10 years or 40,000 tons per year for 5 years as payment. Overall, the fifth phase was to introduce new equipment and technology to improve ore extraction and processing capability, operating and energy efficiency, labor productivity, and the quality of the concentrate.

An economic problem discussed by Mongolia and the U.S.S.R. was the different pricing systems of the two economies. Financial results were dependent on whether rubles or tugriks were used. Annual profits of the Erdenet complex have been estimated to be as high as 600 million tugriks ($179 million).[20] Since the tugrik is not an internationally convertible currency, it is limited to a set exchange rate with the Soviet ruble. The Mongolian Government wanted the copper and molybdenum concentrate to be bought in a freely convertible currency that could be used to purchase foreign, non-Soviet, equipment vital to the country's development and modernization.[21] Together, copper and molybdenum concentrate has accounted for up to 40% of Mongolia's exports. Consequently, any adjustment in exchange rate and payment in a freely convertible currency would be significant to its economy.

Mineral Fuels.—The No. 4 heat and powerplant in Ulaanbaatar reportedly was completed. A minesite thermal powerplant apparently was also commissioned at year-end at the Baga Nuur Mine. The mine was also being expanded to meet increased demand. In addition to supplying coal to the minesite plant, it supplied coal to Ulaanbaatar and for export.

The country's latest 5-year plan (1986-90) projected a rise in coal production from 6.5 million tons in 1985 to 8.0 million tons by 1990, and a 15% rise in annual electricity generation to 3,300 megawatt-hours. Part of the coal production increase would be used for electricity generation.

Further exploration was being done on the large Tavantolgoyt coking coal deposits in southern Gobi Province. The project was receiving assistance from other CMEA countries.

Table 9.—Mongolia: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal destinations, 1986
Aluminum: Metal including alloys, scrap	185	195	All to Yugoslavia.
Barite and witherite	10	--	
Cement[2]	--	13,300	NA.
Chromium: Oxides and hydroxides	--	3	All to Pakistan.
Copper:			
Ore and concentrate	--	7,338	All to Finland.
Sulfate	--	17	All to Japan.
Graphite, natural	--	18	All to Austria.
Iron and steel: Metal: Semimanufactures, universals, plates, sheets	--	92	All to Pakistan.
Stone, sand and gravel: Sand excluding metal-bearing	20	--	
Tin: Ore and concentrate	10	--	

[p]Preliminary. NA Not available.

[1]Table prepared by Audrey D. Wilkes. Owing to a lack of official trade data published by Mongolia, this table should not be taken as a complete presentation of this country's mineral exports. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries. The United States did not report any imports of mineral commodities from Mongolia in 1986.

[2]Statistical Yearbook of Members of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

Table 10.—Mongolia: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal sources, 1986
Abrasives, n.e.s.: Grinding and polishing wheels and stones	--	4	All from Italy.
Aluminum: Metal including alloys, all forms	--	1	All from Austria.
Cement[2]	107,000	48,900	NA.
Coal: Anthracite and bituminous[2]	100	--	
Fertilizer materials: Manufactured:			
Nitrogenous[2]	13,800	14,000	NA.
Phosphatic (P_2O_5 content)[2]	22,100	19,000	NA.
Potassic	99,100	--	
Iron and steel: Metal: Semimanufactures:[2]			
Tubes, pipes, fittings	11,300	11,500	NA.
Unspecified	63,900	74,400	NA.
Petroleum refinery products[2] thousand 42-gallon barrels	5,898	6,077	NA.
Salt and brine	2,729	--	
Sodium compounds, n.e.s.: Carbonate, natural and manufactured[2]	900	1,700	NA.
Stone, sand and gravel: Dimension stone, all forms	53	--	
Sulfur: Sulfuric acid[2]	1,100	1,400	NA.

[p]Preliminary. NA Not available.

[1]Table prepared by Audrey D. Wilkes. Owing to a lack of official trade data published by Mongolia, this table should not be taken as a complete presentation of this country's mineral imports. Unless otherwise specified, these data have been compiled from United Nations information and data published by the trading partner countries. The United States did not report any exports of mineral commodities to Mongolia during 1986.

[2]Statistical Yearbook of Members of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

NEPAL[22]

Mining and quarrying was estimated to contribute less than 0.25% of the GDP. There has been a modest but steady growth in the cement and building materials sector. Agriculture was the backbone of the economy, employing over 90% of the work force and contributing 60% of GDP and 75% of the revenue from exports. Much of Nepal's limited industrial activity involved processing the produce, accounting for 12% to 13% of GDP.

Development of the mining industry was hampered by a paucity of identified natural resources, extremely difficult exploration conditions, and an economy that generated little capital for investment and development. The mineral sector consisted mainly of magnesite and talc mining at Kharidhunga, limestone and cement production at two conventional plants and a miniplant, a small marble quarry at Godavari, and the slow development of a lead and zinc mine high in the mountains at Lare, north of Kathmandu.

Energy is a serious problem in the Nepalese economy. As in other developing countries, energy demand was growing fast. Consumption of energy in Nepal was estimated at 8.4 million tons of coal equivalence in fiscal year (FY) 1986,[23] a large increase from 6.3 million tons in FY 1985. Of the total, 95% came from traditional, noncommercial sources: 76% from fuel wood, 11% from agricultural waste products, and 8% from animal waste. Commercial sources accounted for 5%: 4% from petroleum products and the balance divided equally between coal and hydroelectricity.[24] Overcutting of timber for these needs resulted in environmental problems and caused the Government to look increasingly to other energy sources, especially its vast hydroelectric potential—approximately 83,000 megawatts. Hydroelectric development has been constrained because of high construction cost and the limited domestic market for large amounts of power. A national electricity grid was being developed which would expand power distribution and slow the rapid deforestation by replacing fuel wood for domestic and agriculture needs. New powerplants were also under construction to increase greatly the country's 203-megawatt capacity.

The proposed joint Karnali River hydroelectric project at Chisapani, under consideration by India and Nepal for more than a decade, had additional problems in 1987, mostly political. The dam and 3,500-megawatt powerplant would help control flooding in northern India and provide most of its power to India to offset Nepal's chronic trade deficit. The World Bank was plan-

ning to fund a more detailed feasibility study but India apparently favored a 2,000-megawatt plant at Pancheshwar, reportedly downriver, closer to the Indian border. The estimated cost of either project was $5 billion to $10 billion, which could take years to finance. Several other major hydroelectric projects were under consideration. Each would require considerable foreign assistance and cooperation from India, the major consumer of the power to be generated.

Nepal imported all of its petroleum product needs. The cost of these imports was 33% of the country's export value in 1987. A study of the petroleum potential of Nepal funded by the World Bank indicated possible deposits along its southern border. The Government awarded an exploration contract to a joint venture headed by Shell Exploration B.V. (Netherlands) covering 4,969 square kilometers in the Biratnagar area. The exploration work, begun in 1986, was still under way at yearend.

SINGAPORE[25]

The island state of Singapore is an international trade center in Southeast Asia. Its real GDP increased 8.8% after a recession during 1985-86, when the growth rates were minus 1.6% and 1.9%, respectively. Manufacturing, such as electronic products and components, electrical machinery, and textiles, led the economy, accounting for 44% of the growth, followed by construction and trade. The country has limited natural resources; economic development centered around the processing of imported raw materials, trade, shipping, and services. The principal exports of Singapore were machinery and equipment and mineral fuels. The United States received 30% of Singapore's exports. Investors supported the economy in 1987 by investing $800 million[26] to expand production capacity.

The only significant mining activities were producing 7.3 million tons of granite from small-scale quarries and manufacturing 1.5 million tons of cement from imported clinker. Iron and steel manufacturing from imported metal accounted for the metals sector's largest output in terms of value, and nonferrous metals manufacturing was the second largest.

Singapore remained the leading producer of refined oil in Southeast Asia despite low oil prices and sluggish international demand. There were five oil refineries in Singapore supplying petroleum products to the region. In 1987, Singapore processed an estimated 736,000 barrels per day of crude oil. Mobil Oil Co.'s Jurong oil refinery planned a $20 million expansion of reformer capacity to meet increased domestic demand for gasoline. A reformer produces gasoline having lighter constituents and a higher octane number. Esso Singapore Private Ltd. planned to invest $95 million in a visbreaker, a process for reducing the viscosity of heavy residual oils, at the Pulau Ayer Chawan oil refinery, which has a capacity of 230,000 barrels per day.

In a joint venture with Forasol-Foramer of France and Friede and Goldman, Singapore's Far East Levingston Shipbuilding Ltd. built a $50 million to $60 million offshore drilling rig in its shipyard. The high technology jack-up drilling unit was sold to Santa Fe International Corp. of the United States, an oil drilling company. Far East Levingston also received a contract from Conoco Inc. of the United States for fabricating a major part of an offshore oil platform with 7,000 tons of steel from regional suppliers.[27]

Table 11.—Singapore: Exports and reexports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	37	7	--	All to Brunei.
Oxides and hydroxides	17,665	119,180	--	China 106,832; Malaysia 6,385.
Metal including alloys:				
Scrap	10,707	12,434	(2)	Japan 10,493; Pakistan 621.
Unwrought and semimanufactures	15,681	15,650	73	Malaysia 7,469; Australia 2,618; Hong Kong 707.

See footnotes at end of table.

Table 11.—Singapore: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Chromium:				
Ore and concentrate	18	27	--	All to Australia.
Oxides and hydroxides	29	29	--	Malaysia 27.
Cobalt: Oxides and hydroxides	4	8	--	Malaysia 5.
Columbium and tantalum:				
Ore and concentrate, tantalite	3	393	--	Thailand 303.
Metal including alloys, all forms, tantalum ---- kilograms	30	(3)	--	All to Japan.
Copper:				
Ore and concentrate	250	1	--	NA.
Matte and speiss including cement copper	16	--		
Metal including alloys:				
Scrap	21,726	23,757	92	India 10,457; Japan 7,939; Republic of Korea 2,337.
Unwrought and semimanufactures	9,537	12,284	1	Malaysia 9,901; Hong Kong 604.
Gold:				
Waste and sweepings -- kilograms	759	1,280	2	West Germany 750; Japan 306; United Kingdom 100.
Metal including alloys, unwrought and partly wrought -- troy ounces	63,691	132,750	129	Malaysia 58,450; Japan 33,823; West Germany 15,882.
Iron and steel:				
Ore and concentrate excluding roasted pyrite	21	19	--	All to Hong Kong.
Metal:				
Scrap	166,636	90,776	--	Thailand 37,758; Japan 34,244.
Pig iron, cast iron, related materials	3,599	1,413	--	Malaysia 1,293.
Ferroalloys	1,126	548	--	Malaysia 400; Australia 100.
Steel, primary forms	8,627	5,124	1	Malaysia 3,944; Taiwan 979.
Semimanufactures	353,001	369,760	102,845	Malaysia 125,752; Brunei 20,398; Japan 17,691.
Lead:				
Ore and concentrate	21	10	--	All to India.
Oxides	2,147	233	--	Malaysia 162; Japan 51.
Metal including alloys:				
Scrap	7,057	5,103	--	Taiwan 1,660; Malaysia 1,067; India 999.
Unwrought and semimanufactures	857	5,760	--	Malaysia 1,827; Thailand 1,553.
Magnesium: Metal including alloys, all forms	44	33	--	North Korea 16; Thailand 5.
Manganese:				
Ore and concentrate, battery-grade	21,954	23,565	--	Republic of Korea 4,303; India 3,650; Kenya 3,540.
Oxides	1,239	976	--	Malaysia 749; North Korea 120.
Mercury ---- 76-pound flasks	290	174	--	North Korea 145.
Nickel:				
Matte and speiss	1	1,307	--	India 1,302.
Metal including alloys:				
Scrap	1,072	280	4	Japan 205; United Kingdom 44.
Unwrought and semimanufactures	2,480	2,714	--	India 2,531.
Platinum-group metals: Metals including alloys, unwrought and partly wrought troy ounces	8,456	1,800	--	Japan 1,093; United Kingdom 322.
Silver:				
Ore and concentrate[4]	(2)	--		
Waste and sweepings[4] -- kilograms	18,452	1,447	--	United Kingdom 1,146; Japan 192.
Metal including alloys, unwrought and partly wrought -- troy ounces	59,543	121,337	27,199	Malaysia 28,260; Thailand 9,099.
Tin:				
Ore and concentrate	9,728	4,892	120	Malaysia 2,728; Republic of Korea 785; Spain 761.
Ash and residue containing tin	1,012	571	--	Taiwan 291; West Germany 250.
Metal including alloys:				
Scrap	137	75	--	Taiwan 64.
Unwrought and semimanufactures	20,458	30,157	6,474	Japan 9,402; Netherlands 5,075; U.S.S.R. 1,800.
Titanium: Oxides	821	1,445	--	Malaysia 579; India 454; Japan 123.
Tungsten:				
Ore and concentrate	1,438	732	109	India 276; Hong Kong 152.
Metal including alloys, all forms	68	52	32	Italy 5; France 4.

See footnotes at end of table.

Table 11.—Singapore: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Zinc:				
Ore and concentrate	2	42	--	Thailand 30; Malaysia 12.
Oxides	1,446	625	--	China 294; Japan 199.
Metal including alloys:				
Scrap	662	651	--	Taiwan 277; Japan 156; India 107.
Unwrought and semimanufactures	3,363	4,108	--	Malaysia 2,299; Netherlands 680.
Other:				
Ores and concentrates	245	388	--	Malaysia 170; Thailand 160.
Ashes and residues	31,362	49,310	--	Malaysia 25,303; Brunei 12,996; Philippines 6,501.
Base metals including alloys, all forms	83	144	--	Australia 76; North Korea 35.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	110	47	--	Malaysia 35.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$48	$1	--	NA.
Grinding and polishing wheels and stones	370	275	1	Malaysia 194; Thailand 28.
Asbestos, crude	7,117	4,276	--	Malaysia 4,273.
Barite and witherite	32,431	12,939	--	Malaysia 10,100; New Zealand 1,119.
Boron materials:				
Crude natural borates	18,986	10	--	All to Malaysia.
Oxides and acids	135	183	--	Malaysia 161.
Cement	307,287	66,927	--	Malaysia 35,167; Brunei 9,780; Republic of South Africa 6,778.
Chalk	2,359	2,781	--	Brunei 1,609; Malaysia 861.
Clays, crude	22,668	12,065	--	Malaysia 5,054; Philippines 1,849; Japan 1,590.
Diamond:				
Gem, not set or strung value, thousands	$15,151	$8,539	$1,217	Hong Kong $2,295; Malaysia $1,995; Belgium-Luxembourg $1,236.
Industrial stones ---do---	$444	$264	--	Hong Kong $128; Ireland $46.
Diatomite and other infusorial earth	202	115	--	Malaysia 71; Thailand 15.
Feldspar	4,314	3,585	--	Malaysia 3,278.
Fertilizer materials:				
Crude, n.e.s	40,069	40,654	--	Malaysia 40,570.
Manufactured:				
Ammonia	560	307	--	Malaysia 179; Thailand 68.
Nitrogenous	86,814	17,877	--	Malaysia 8,752; Philippines 3,970; Papua New Guinea 1,935.
Phosphatic	2,129	16,356	--	Republic of South Africa 14,446; Malaysia 1,649.
Potassic	174,015	141,368	--	Malaysia 52,882; Sri Lanka 47,267; Thailand 10,918.
Unspecified and mixed	57,964	54,128	--	Malaysia 48,135; Republic of South Africa 3,439.
Graphite, natural	91	77	--	Malaysia 73.
Gypsum and plaster	2,666	2,739	--	Malaysia 2,608.
Lime	5,081	2,919	--	Brunei 1,583; Malaysia 707; Guinea 528.
Magnesium compounds: Magnesite, crude including magnesia	245	172	--	Taiwan 108; North Korea 36.
Mica, all forms	226	62	--	Malaysia 31; Japan 9.
Nitrates, crude	74	555	--	Republic of South Africa 475.
Phosphates, crude	3,499	2,605	--	Malaysia 2,190.
Pigments, mineral: Iron oxides and hydroxides, processed	1,289	639	--	Malaysia 562.
Potassium salts, crude	330	--		
Precious and semiprecious stones other than diamond:				
Natural ----- value, thousands	$5,337	$3,559	$10	Thailand $1,467; Switzerland $644; Hong Kong $413.
Synthetic ---do---	$209	$412	--	Thailand $214; Republic of Korea $87.
Pyrite, unroasted	4	--		
Salt and brine	13,817	9,216	--	Malaysia 6,198; Brunei 2,677.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	4,688	1,387	--	Malaysia 1,297.
Sulfate, manufactured[5]	6,120	11,038	--	Malaysia 10,084.

See footnotes at end of table.

Table 11.—Singapore: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	217	233	--	Malaysia 199.
Worked	6,046	4,715	69	Malaysia 3,371; Brunei 470.
Dolomite, chiefly refractory-grade	22	1,268	--	Taiwan 963; Papua New Guinea 295.
Gravel and crushed rock	717	390	--	Malaysia 339.
Limestone other than dimension	234	86	NA	NA.
Sand other than metal-bearing	601	698	--	Malaysia 363; Brunei 164.
Sulfur:				
Elemental:				
Crude including native and by-product	7,338	15,885	--	Malaysia 12,454; Thailand 1,964.
Colloidal, precipitated, sublimed	7,051	10,600	--	Malaysia 5,529; Thailand 2,900; Philippines 1,780.
Sulfuric acid	2,581	1,743	--	Malaysia 1,157.
Talc, steatite, soapstone, pyrophyllite	832	512	--	Malaysia 510.
Other:				
Crude	17,220	5,379	--	Malaysia 2,149; Philippines 1,540; Thailand 1,502.
Slag and dross, not metal-bearing	11,150	7,480	--	Japan 5,741; Malaysia 1,411.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	20,135	19,387	--	Burma 6,571; Sri Lanka 4,086.
Carbon black	3,274	5,632	576	India 540; Japan 448; Malaysia 372.
Coal, all grades including briquets	478	1,607	--	Malaysia 1,270.
Coke and semicoke	14,731	17,462	--	Malaysia 13,829; Bangladesh 2,060.
Petroleum:				
Crude thousand 42-gallon barrels	622	649	--	All to Thailand.
Partly refined do	829	689	516	Japan 153.
Refinery products do	193,971	216,866	14,517	Japan 47,650; Malaysia 34,992; Hong Kong 33,110.

NA Not available.
[1]Table prepared by Audrey D. Wilkes.
[2]Less than 1/2 unit.
[3]Unreported quantity value at $6,000.
[4]May include other precious metals.
[5]Includes hydrogen sulfate and pyrosulfate.

Table 12.—Singapore: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	410	20	--	China 10; Australia 5.
Oxides and hydroxides	48,702	103,137	428	Australia 101,491.
Metal including alloys:				
Scrap	771	845	50	Malaysia 503; Brunei 145.
Unwrought and semimanufactures	46,896	44,941	1,516	Australia 9,359; Japan 5,493; Malaysia 5,193.
Beryllium: Metal including alloys, all forms	--	12	--	Mainly from Japan.
Chromium:				
Ore and concentrate	19	8	NA	NA.
Oxides and hydroxides	220	151	74	United Kingdom 34; Japan 23.
Cobalt: Oxides and hydroxides	5	29	2	China 25.
Columbium and tantalum:				
Ore and concentrate, tantalite	68	(2)	--	NA.
Metal including alloys, all forms, tantalum	(2)	46	36	Finland 9.

See footnotes at end of table.

Table 12.—Singapore: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Copper:				
Ore and concentrate	5	12	--	United Kingdom 8.
Matte and speiss including cement copper	12	16	--	Malaysia 12.
Metal including alloys:				
Scrap	3,587	7,401	2,077	Malaysia 4,290.
Unwrought	2,249	5,660	118	Chile 3,157; Japan 1,856.
Semimanufactures	34,161	34,169	617	Japan 18,349; Malaysia 3,173; Taiwan 3,021.
Gold:				
Waste and sweepings value, thousands	$1,442	$3,839	--	Malaysia $2,160; West Germany $829; Hong Kong $532.
Metal including alloys, unwrought and partly wrought troy ounces	105,937	125,002	15,464	Japan 87,579; United Kingdom 16,654.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	12,581	10,167	--	All from Malaysia.
Metal:				
Scrap	65,402	209,091	174	United Kingdom 119,201; Australia 37,399; U.S.S.R. 28,068.
Pig iron, cast iron, related materials	46,614	60,015	57	U.S.S.R. 30,000; Mozambique 22,875.
Ferroalloys:				
Ferromanganese	6,186	3,183	--	Mozambique 2,974.
Ferrosilicon	1,940	2,718	--	Mozambique 1,080; Norway 981; China 460.
Unspecified	1,542	4,898	33	Australia 2,502; Mozambique 1,838.
Steel, primary forms	163,018	245,461	18	New Zealand 45,700; Netherlands 40,143; Malaysia 25,934.
Semimanufactures thousand tons	1,349	1,289	8	Japan 697; Malaysia 112; Republic of Korea 107.
Lead:				
Ore and concentrate	20	1	1	
Oxides	274	381	1	Australia 211; China 55.
Metal including alloys:				
Scrap	104	133	12	Malaysia 63; Brunei 56.
Unwrought	5,457	9,673	49	Japan 6,939; Australia 1,386.
Semimanufactures	1,322	831	12	Australia 331; Taiwan 177; United Kingdom 132.
Magnesium: Metal including alloys, all forms	85	68	19	Japan 43.
Manganese:				
Ore and concentrate	35,923	28,846	--	Gabon 15,750; Brazil 9,846; Mexico 3,056.
Oxides	2,440	2,327	2	Japan 1,985.
Mercury 76-pound flasks	735	928	377	China 464.
Nickel: Metal including alloys:				
Scrap	170	182	21	Malaysia 61; Philippines 32.
Unwrought	2,638	3,726	1	New Caledonia 1,971; France 1,559.
Semimanufactures	774	1,410	103	Japan 426; Norway 339.
Platinum-group metals: Metals including alloys, unwrought and partly wrought troy ounces	34,240	17,394	--	West Germany 12,764; United Kingdom 965.
Silver:				
Ore and concentrate value, thousands	--	$1	--	NA.
Waste and sweepings[3] do.	$341	$55	--	Hong Kong $21; Malaysia $13.
Metal including alloys, unwrought and partly wrought thousand troy ounces	1,282	3,145	202	Australia 1,025; West Germany 666; United Kingdom 490.
Tin:				
Ore and concentrate	8,315	5,501	177	China 3,556; Burma 668.
Ash and residue containing tin	8,481	9,585	--	Malaysia 9,534.
Metal including alloys:				
Scrap	337	281	1	Malaysia 216.
Unwrought and semimanufactures	1,371	13,030	21	Thailand 6,629; Malaysia 5,236.
Titanium: Oxides	6,854	8,725	1,171	Japan 2,702; Australia 1,268; West Germany 996.
Tungsten:				
Ore and concentrate	1,699	1,235	--	Burma 1,057.
Metal including alloys, all forms	28	102	3	China 90.

See footnotes at end of table.

Table 12.—Singapore: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Uranium and/or thorium:				
Oxides and other compounds value, thousands	$111	$130	$25	France $84.
Metals including alloys, all forms kilograms	58	2	NA	NA.
Zinc:				
Ore and concentrate	--	40	9	Australia 14; Malaysia 13.
Oxides	968	957	38	China 302; Belgium-Luxembourg 144.
Metal including alloys:				
Scrap	415	221	--	All from Malaysia.
Unwrought and semimanufactures	10,980	13,277	224	Australia 6,251; Canada 2,983.
Other:				
Ores and concentrates	352	605	--	Burma 250; Malaysia 160.
Ashes and residues	114,576	177,613	--	Japan 157,465; Philippines 11,114.
Base metals including alloys, all forms	85	31	18	Thailand 7.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	437	516	371	Hong Kong 37; China 36.
Artificial: Corundum	37	30	--	China 18; Japan 12.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$51	$406	$320	France $68.
Grinding and polishing wheels and stones	1,704	2,350	48	China 1,208; Japan 465.
Asbestos, crude	6,078	3,987	91	Canada 2,090.
Barite and witherite	18,116	14,382	1,284	Malaysia 10,128; Thailand 2,157.
Boron materials:				
Crude natural borates	1,281	109	109	
Oxides and acids	573	498	88	Italy 292; China 64.
Cement thousand tons	2,701	2,103	(2)	Japan 697; Taiwan 532; Malaysia 459.
Chalk	3,865	5,735	3	Australia 1,498; United Kingdom 1,247; Thailand 1,148.
Clays, crude	50,186	60,625	34,509	Malaysia 13,672; United Kingdom 3,508.
Cryolite and chiolite	5	5	--	All from China.
Diamond:				
Gem, not set or strung value, thousands	$30,521	$39,843	$3,535	India $14,943; Belgium-Luxembourg $10,457; Israel $8,057.
Industrial stones do	$1,522	$644	$45	Ireland $427; Iceland $61.
Diatomite and other infusorial earth	866	963	918	Malaysia 12.
Feldspar	5,992	4,413	31	India 2,428; China 1,262; Thailand 353.
Fertilizer materials:				
Crude, n.e.s	3,703	778	--	Thailand 462; Australia 152.
Manufactured:				
Ammonia	772	621	4	Malaysia 212; Belgium-Luxembourg 178; West Germany 124.
Nitrogenous	79,860	5,256	23	West Germany 2,263; Malaysia 823; Australia 732.
Phosphatic	3,163	22,456	21,573	China 450; Republic of Korea 350.
Potassic	189,366	155,536	(2)	Canada 60,065; U.S.S.R. 58,100; Israel 15,804.
Unspecified and mixed	62,036	42,091	116	West Germany 33,854; Malaysia 2,484.
Graphite, natural	427	407	2	Japan 167; China 121; Republic of Korea 78.
Gypsum and plaster	97,845	56,130	191	Thailand 25,191; Australia 17,924; Malaysia 6,077.
Lime	11,208	5,010	--	Malaysia 4,452; China 300.
Magnesium compounds: Magnesite, crude including magnesia	791	472	18	Norway 255; Japan 154.
Mica:				
Crude including splittings and waste	1,220	496	84	India 253; China 100.
Worked including agglomerated splittings	54	17	(2)	Japan 14.
Phosphates, crude	5,219	4,920	--	India 1,630; Australia 1,400; Malaysia 1,198.
Pigments, mineral: Iron oxides and hydroxides, processed	2,948	3,058	561	West Germany 966; Japan 857; China 216.
Potassium salts, crude	1	30	--	All from Switzerland.

See footnotes at end of table.

Table 12.—Singapore: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Precious and semiprecious stones other than diamond:				
Natural ____ value, thousands__	$4,287	$2,834	$458	Hong Kong $778; Thailand $576; Sri Lanka $350.
Synthetic ____ do____	$688	$737	$107	U.S.S.R. $272; Thailand $183.
Pyrite, unroasted	--	43	31	NA.
Salt and brine	36,102	36,700	83	Thailand 11,087; Australia 6,723; China 6,091.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	5,288	347	20	East Germany 152; Australia 59; Japan 58.
Sulfate, manufactured[4]	7,652	20,748	16,226	Taiwan 2,140; China 1,614.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	2,275	1,228	1	Italy 654; China 206; Malaysia 157.
Worked	56,675	34,529	38	Italy 18,796; China 5,641; Portugal 2,562.
Dolomite, chiefly refractory-grade	1,192	127	37	Norway 62.
Gravel and crushed rock	779,438	697,463	11	Malaysia 696,126.
Limestone other than dimension	80,543	72,178	--	Malaysia 44,933; Japan 27,154.
Quartz and quartzite	126	172	--	Malaysia 89; China 49.
Sand other than metal-bearing thousand tons	1,203	1,205	1	Malaysia 1,192.
Sulfur:				
Elemental:				
Crude including native and by-product	34	142	9	China 70; Poland 54.
Colloidal, precipitated, sublimed	127	510	356	Poland 72; Republic of Korea 54.
Sulfuric acid	263	302	21	Malaysia 146; West Germany 104.
Talc, steatite, soapstone, pyrophyllite	3,986	6,205	235	China 4,278; Republic of Korea 533.
Other:				
Crude	39,753	32,489	--	West Germany 30,841.
Slag and dross, not metal-bearing	6,726	12,818	(2)	Taiwan 6,574; Japan 6,067.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2,643	2,186	398	Japan 871; Republic of Korea 519.
Carbon black	4,523	4,621	351	Malaysia 2,271; West Germany 408.
Coal, all grades including briquets	2,148	1,825	878	United Kingdom 715.
Coke and semicoke	31,727	27,434	--	Japan 16,487; Australia 10,753.
Peat including briquets and litter	166	182	--	Netherlands 78; United Kingdom 42; Ireland 37.
Petroleum:				
Crude thousand 42-gallon barrels	218,831	236,830	--	Kuwait 50,954; Iran 49,561; China 47,014.
Partly refined ____ do____	2,378	2,732	--	Malaysia 2,251; Kuwait 480.
Refinery products ____ do____	71,278	79,340	4,338	Saudi Arabia 25,229; Kuwait 15,845; Bahrain 11,658.

NA Not available.
[1]Table prepared by Audrey D. Wilkes.
[2]Less than 1/2 unit.
[3]May include other precious metals.
[4]Includes hydrogen sulfate and pyrosulfate.

SRI LANKA[28]

Sri Lanka's mining industry produced around 18 minerals or mineral-based commodities during the year. The most important were cement, clays, gem stones, graphite, gypsum, mica, minerals associated with typical heavy mineral sands deposits, phosphate rock, salt, and rolled steel (from imported ingot and scrap). The value of mineral industry output, including the petroleum refinery sector, was 2% of GDP.

Economic performance in 1987 was the poorest since 1975 with real GDP growth dropping to 1.5% over 1986. Growth by sector varied widely. Agriculture, by far the most important part of the economy, declined 8% below 1986 while the value of factory industry output increased 8% over that of 1986. Drought was an important negative factor. A considerable amount of farmland was not planted in the north and east because of continuing civil disturbances in those areas.

Unemployment continued at a rate estimated at more than 20%. Prospects for a

rebound in economic growth in 1988 were good providing normal rainfall is received during the growing season.

Sri Lanka had a trade deficit of $658 million during 1987, a slight improvement over the $731 million deficit of 1986.[29] The major mineral exports were gem stones, graphite, and titanium, while fertilizer, petroleum, and steel raw materials were the most important mineral imports.

COMMODITY REVIEW

Industrial Minerals.—*Feldspar and Fluorspar.*—Exploration in the Matale District of Central Province by the Industrial Development Board has revealed, reportedly, rich deposits of feldspar and fluorspar. The Ceramic Corp. plans to increase its ceramic and porcelain production capacities. These new deposits could be important because Sri Lanka has never produced fluorite and has produced very modest quantities of feldspar.

Fertilizer Materials.—The 40-million-ton Eppawela apatite deposit has been underutilized because of the insoluability of the phosphate. Sri Lanka's scientists have reportedly perfected a technology for increasing the solubility of the phosphate radical using hydrochloric acid rather than more commonly used sulphuric acid. If commercially successful, the new process could allow Sri Lanka considerable savings in superphosphate import costs. The Sri Lanka Institute of Fundamental Studies was reportedly seeking local and foreign assistance to construct and operate a pilot plant. The Eppawela operation consisted of a mine and 15,000-ton-per-year grinding plant. The finely ground phosphate has been applied directly for perennial crops and trees. The State Mining and Mineral Development Corp. has applied to the Government for approval to increase the grinding capacity to 35,000 tons per year with funding from the Asian Development Bank.

Gem Stones.—The Sri Lankan Government was scheduled to sign an agreement with Thailand legalizing geuda exports for those who obtain special trading permits and would export through the Government's State Gem Corp. Geuda is a milky, rough form of the mineral corundum, formerly a waste material from gem stone pits. The Thai gem stone merchants discovered in the early 1970's that proper heating of geuda cleared the cloudiness and changed the color to blue, making it into sapphire. Smuggling of gem stones and geuda from Sri Lanka to Thailand had become so widespread that the Government sought to increase its revenue from the gem stone industry by signing the agreement with Thailand. At current exchange rates, legal gem stone exports have totaled as much as $50 million annually.

It has been common knowledge in the gem stone mining center of Ratnapura that the value of gem stones smuggled out of the country annually has been several times that of legal exports. The Government has not announced the value but conceded that there were "vast quantities" of gem stones illegally exported.[30]

Geologists testing alluvial gravel in the Koslanda area have identified potentially gem-quality diamond deposits. The reports have attracted prospectors and speculators from all over the world. The main area of interest was along the Menick Ganga in the Central Province close to the Diyaluma waterfall, a famous tourist attraction.

Graphite.—To improve the production and export potential for its Bogala and Kahatagala graphite mines, the Government-owned Mining and Mineral Development Corp. reportedly expended $18 million between 1982 and 1987. Much of the cost was financed by the Asian Development Bank. Orders were received for more than 3,000 tons of graphite for 1988 compared with 1,000 tons for 1987. Most of the increase was for refractory-grade graphite from the Kahatagala and adjacent Kolongaha Mines. The mines had a considerable stockpile of graphite because of insufficient demand.[31]

Mineral Sands.—Late in 1987, the National Aquatic Research Agency reported the discovery of monazite-bearing mineral sands on the continental shelf along the northern and southwestern coasts. The placer deposits are at a depth of 10 to 15 meters about 8 kilometers offshore. These deposits can be mined easily with conventional dredging equipment.[32] Monazite was recovered as a byproduct of mineral sands at Pulmoddai on the northeast coast, where ilmenite, rutile, and zircon were major economic minerals.

Mineral Fuels.—A Single Point Buoy Mooring system was installed 9.2 kilometers off the coast near Sapugaskanda and was connected to shore during 1987 with a 914-millimeter pipeline. The buoy system allowed deepdraft tankers to unload crude oil directly without transshipping or lightering. The land terminus of the pipeline is

Orugodawatta, where four 290,000-barrel crude oil storage tanks were under construction at yearend. The oil will be pumped from these tanks through a 610-millimeter pipeline to the refinery at Sapugaskanda. The $36 million project was expected to save $7.5 million per year in freight charges. The Ceylon Petroleum Corp. planned to modernize the refinery by broadening its range of products and increasing its liquefied petroleum gas capacity. Tenders were to be offered during the last half of 1987.

VIETNAM[33]

The most important event of the minerals industry was the rapid development of the Bach Ho offshore oilfield, 160 kilometers southeast of Ho Chi Minh City. The reserves were not revealed, but the Vietnamese and Soviet Governments were confident enough to begin priority construction of a 60,000-barrel-per-day oil refinery at Tuy Ha. If production increases as planned, the value of the petroleum would surpass by 1990 that of any other mineral commodity produced in Vietnam.

Economic problems continued. The GDP was one of the lowest in the world at $100 per capita. Unemployment was 30%; the foreign debt was between $6 billion and $7 billion; and the inflation rate was in the triple digits. To improve the economy, the National Assembly passed in December a foreign-investment law to attract Western capital and businesses. Under this law, foreign investors may have 100% equity in any venture. They can set up joint ventures with a minimum of 30% foreign capital. The tax on profits would range from 15% to 25%, and the nationalization of foreign property would be prohibited. A tax holiday may be granted for important projects for 2 years followed by a 50% reduction for another 2 years.

Vietnam was believed to have exploitable deposits of bauxite, coal, chromite, gold, iron ore, tin, and titanium. The lack of funds and expertise has prevented their exploitation. The Government was hoping that foreign investment would be available for developing some of these deposits. In the long run, Vietnam's success in attracting foreign investors will depend primarily on the flexibility and cooperation of the Government.

The U.S.S.R. was Vietnam's biggest trading partner, accounting for 80% of Vietnam's imports. The most important of these were fertilizer, fuel, machinery and equipment, and rolled steel. Vietnam's exports, again mostly to U.S.S.R., were primarily nonminerals, including coffee, fruit, lumber, rubber, and tea. Mineral exports were not large but of potential importance. Between 500,000 and 700,000 barrels of crude oil were exported during 1987. About 500,000 tons of anthracite and a few hundred tons of tin metal were the other most significant mineral exports. Gypsum for the cement industry was supplied by Laos.

Balance of payment and increasing trade deficits caused problems for the economy. Exports increased by 8%, while imports 14%. Plans were to increase exports 17% in 1988 and hold imports to a practical minimum.

The Government has a continuing program to gather basic geological data both onshore and offshore along its 3,444-kilometer coastline. The offshore work was being assisted financially and technologically by the U.S.S.R. The Institute of Pacific Oceanography of the Soviet Academy of Sciences was the major group working with and training scientists from the Institute of Oceanography of the Vietnam Institute of Science. Geological and geophysical surveying and mapping of the continental shelf have been performed. The topography of the seafloor has been mapped and cross sections of the underlying structure were prepared. The work has produced not only accurate data for further mineral resource evaluation but also a cadre of well-trained has produced a cadre of well-trained Vietnamese scientists versed in modern oceanography techniques.[34]

Onshore exploration was to be strengthened through an agreement with the Government of Czechoslovakia to aid in geological surveys and exploration during 1988-90.

The General Department of Mines and Geology's mineral analysis capability reportedly was enhanced by doubling the Dalat Atomic Research Institute's nuclear reactor capacity to 500 kilowatts. The institute produced radioactive isotopes for medical and analytical testing. The content of copper, gold, silver, and other metals in soil samples can now by determined at the institute. These analyses have been performed previously in other countries.

COMMODITY REVIEW

Metals.—The bauxite mines in Bao Loc District, Lam Dong Province, have been entirely mechanized and the ore grade has improved from a concentrate of 43% to one of 46% aluminum oxide content. The grade improvement could indicate the installation of a washing plant as part of the mechanization. The small mine furnishes bauxite for chemicals and abrasives.

Construction of a 22,000-ton-per-year "soft iron" plant at the Thai Nguyen iron and steel complex was completed. The plant began operating in November, 1 year ahead of schedule. It was designed and built completely by personnel at Thai Nguyen. The Vietnam press did not provide a definition of "soft iron" but stated it was the first of its kind in the country. The soft iron would be used in electric furnaces for producing steel ingot.

Industrial Minerals.—*Cement.*—The Federation of Cement Enterprises reported that production of 1.5 million tons of portland cement in 1987 was the highest ever. Despite the record high, serious problems still remained. The industry had an installed capacity of 3.4 million tons per year. Raw material shortages and transportation were the major causes for low capacity utilization of two modern rotary-kiln plants. A Nhan Dan newspaper editorial detailed how poor planning resulted in the 1-million-ton-per-year facilities having inadequate limestone, other raw materials, energy supplies, communication, transportation, bag filling capacity, and warehousing. "Careful efforts were not made from the very beginning to train, develop, and prepare a technical and professional force of managers and operators and to repair equipment," the editorial said.[35] There have been other press references to a rapid decline because of poor maintenance and the need for a large investment to regain capacity.

A 5,000-ton-per-year vertical kiln cement mill began operating in December at Chieng Pac, Thuan Chan District, Son La Province. Many of the plant components were made locally. These cement minimills are scattered throughout the country and have an aggregate capacity of 500,000 tons per year. Output from the plants depends largely on the availability of electric power and fuel.

Fertilizer Materials.—The Soviet Union has been assisting in the improvement of the Lao Cai apatite mine in Hoang Lien Son Province. A total of 25 main projects have been completed in the long-term rebuilding of the mine facilities, which were severely damaged during a border dispute with China in February 1979. Nearly 90,000 cubic meters of concrete have been poured and 1,000 tons of equipment has been installed for recent projects. A new electric power system was under construction as were railroad facilities. An ore dressing mill was under construction at yearend to process low-grade ore that had been underutilized or discarded for years. No details were available about the type and capacity of the mill.

The Vietnamese press reported plans for the country's second superphosphate plant. It was to be located in Long Thanh, 25 kilometers east of Ho Chi Minh City, and have a capacity of 45,000 tons per year.

Because the agriculture sector commands the highest priority in economic planning, fertilizer production is of critical importance. An article in the Hanoi press in December described the phosphate fertilizer industry and the nature of severe and persistent problems of production and distribution.[36] The target for superphosphate production at Lam Thao was 310,000 tons in 1987. However, each step in the production process had problems. Domestic pyrite production was inadequate and sufficient imports could not be obtained because of a lack of foreign exchange. Pyrite from Albania was delivered late. The next most serious problem was transportation. Local raw material movement was hampered by a shortage of railcars and trucks for highway use. Although 135 railcars were needed daily to transport apatite to Lam Thao, only 85 to 90 were available. Distribution of the phosphate fertilizer went no smoother than production. Rail distribution was less than 50% of that planned. The truck shortage prevented the railroad shortfall from being delivered by highway. Undelivered fertilizer was a problem because, without warehouses, it was stacked outside where it washed into a river when it rained. Transportation losses were as high as 30%, with pilferage accounting for most. The other problem was the quality of the phosphate. Open storage of single superphosphate caused the P_2O_5 content to leach from the standard of 16.5% to less than 9% in many cases.

Mineral Sands.—The Vietnamese press announced plans for building a 20,000-ton-per-year ilmenite recovery plant. Titaniferous sand deposits, 0.5 to 1.0 meter thick

and 15 to 30 meters wide, have been identified along the coasts of Binh Tri Thien, Nghia Binh, and Phu Khanh Provinces. The Binh Tri Thien deposits have the highest zirconium content and extend 60 kilometers along the coast. The Vietnamese will probably require assistance for plant design.[37]

Sulfur.—Five organizations, including one from the Soviet Union, were involved in enlarging the Giap Lai iron pyrite mine in Vinh Phu Province. The work was being done also to improve efficiency and reduce supplies and fuel consumption.

Mineral Fuels.—*Coal.*—The production target of 6.1 million tons was met in 1987. The goal was met despite such problems as a lack of construction capital, a shortage of spare parts, a poor transportation system, and a shortage of electric power. Of greater concern was the gradual deepening of the mines and the resulting higher cost of production. In major Hong Gai coal mines during the 1970's the stripping ratio was 3 to 4 cubic meters of overburden for each ton of coal, whereas in 1987, twice the amount of overburden removal was necessary. In many cases, mining was still done with the same equipment as that of the 1970's. Similarly the underground mines were deeper as the upper levels have been worked out. Coal was one of Vietnam's major exports, but the output of high-quality coal demanded by foreign clients was falling, making the quality more difficult to maintain. A Hong Gai Coal Co. representative stated that production could not be increased without improving technology and finding new, presumably shallower, deposits. Labor relations and morale were of concern to management. Miner salaries were not much higher than other workers. The company representative stated that difficult and dangerous working conditions underground should justify a much higher wage scale. Ironically because of financial problems, miners received one-half their salary during the fourth quarter of 1987 and nothing in January 1988.

The coal sector has long been a recipient of much of the Soviet Union's technical and financial aid. The aid accounted for more than 85% of the nation's coal production capacity. Another technical cooperative agreement was being prepared for 1988-90. The draft agreement contained the following main provisions: Maintain production at six major mines and two large equipment maintenance plants, build coal region infrastructure to increase efficiency, expedite existing projects and postpone several projects until investment capital becomes available. Some of the projects were as follows: the creation of an Institute of Economics and Coal Planning; a 960-seat vocational school at Cam Pha; production coordination between the ministry and mines; central storehouses to protect equipment and materials; a 500-bed hospital for coal workers; cultural centers for workers at the Coc 6 Mines; additional research equipment for the Mining Institute; and housing and cultural amenities in the mining regions.

Petroleum.—Vietnam's embryonic petroleum sector was one of the few sectors of the mineral industry that was progressing as planned. The joint Soviet-Vietnam venture, Vietsovpetro, began crude production at its No. 4 offshore platform in August, 2 months ahead of schedule. The No. 5 platform was installed and nearly ready for drilling.

Construction workers at the oil support base at Vung Tau have increased their proficiency with each new platform. The No. 6 platform jacket was assembled in 2 months, 10 months quicker than the No. 1 platform jacket. Much time was saved by doing some of the heavy welding onsite, rather than waiting for preformed and welded parts from the U.S.S.R.

Crude production increased as the new platforms were brought into operation. Production capacity was estimated to be 6,000 barrels per day by yearend. The average output, however, was probably less because production reportedly ceased during inclement weather.

Vietsovpetro scheduled 19 exploratory wells and a production of 5 million barrels of crude oil for 1988.

The Oil Refinery Construction Corp. of the Ministry of Building has completed preliminary site preparation, 50,000 square meters of roads and storage yards, and 10,700 square meters of worker housing at the Tuy Ha Oil refinery, which is halfway between Vung Tau and Ho Chi Minh City. Initial capacity of the refinery was to be 60,000 barrels per day with a capability to double that.

A mini-oil refinery was being constructed by Saigon PETRO, a joint venture of four Vietnamese organizations, at Cat Lai, Thu Duc District on the outskirts of Ho Chi Minh City. The refinery was to have a capacity of 1,000 barrels per day and apparently function as a topping plant and refinery research facility for domestic crude oil. Completion was scheduled for early 1988.

[1]By Gordon L. Kinney, physical scientist, Division of International Minerals.
[2]U.S. Embassy, Dhaka, Bangladesh. State Dep. Airgram A-20, Oct. 13, 1987, p. 1.
[3]Fertilizer Focus (Surrey). V. 4, No. 12, Jan. 1988, p. 34.
[4]Oil & Gas Journal (Tulsa). V. 86, No. 9, Feb. 29, 1988, pp. 76-82.
[5]By Gordon L. Kinney, physical scientist, Division of International Minerals.
[6]U.S. Embassy, Bandar Seri Begawan. State Dep. Airgram A-3, Sept. 21, 1987, p. 15.
[7]Values have been converted from Brunei dollars (B$) at the rate of B$2.10=US$1.00.
[8]Journal of Commerce. V. 376, No. 26,612, Jan. 15, 1988, p. 10B.
[9]By Gordon L. Kinney, physical scientist, Division of International Minerals.
[10]Hanoi. Vietnam News Agency Broadcast. 0558 GMT, Jan. 5, 1988.
[11]———. Vietnam News Agency Broadcast. 1453 GMT, May 13, 1987.
[12]By Travis Q. Lyday, physical scientist, Division of International Minerals.
[13]By E. Chin, physical scientist, Division of International Minerals.
[14]Where necessary, values have been converted from Hong Kong dollars (HK$) to U.S. dollars at the rate of HK$7.815=US$1.00 in 1987.
[15]By Chin S. Kuo, physical scientist, Division of International Minerals.
[16]Where necessary, values have been converted from Korean won (W) to U.S. dollars at the rate of W0.94=US$1.00 for 1987.
[17]By Gordon L. Kinney, physical scientist, Division of International Minerals.
[18]Vientiane Mai in Lao (Vientiane). Nov. 24, 1987, p. 1.
[19]By Gordon Kinney, physical scientist, Division of International Minerals.
[20]Where necessary, values have been converted from Mongolian tugriks (Tug) at the rate of Tug3.35=US$1.00.
[21]Far Eastern Economic Review (Hong Kong). V. 137, No. 34, Aug. 20, 1987, p. 65.
[22]By Gordon L. Kinney, physical scientist, Division of International Minerals.
[23]The Nepalese fiscal year begins in mid-July of the year stated.
[24]U.S. Embassy, Kathmandu, Nepal. State Dep. Airgram A-01, Jan. 25, 1988, p. 7.
[25]By Chin S. Kuo, physical scientist, Division of International Minerals.
[26]Where necessary, values have been converted from Singapore dollars (S) to U.S. dollars at the rate of S$2.11=US$1.00 for 1987.
[27]American Metal Market. Nov. 16, 1987, p. 2.
[28]By Gordon L. Kinney, physical scientist, Division of International Minerals.
[29]Where necessary, values have been converted from Sri Lankan rupees (Rs) to U.S. dollars at the rate of Rs29.44=US$1.00 for 1987.
[30]Asian Wall Street Journal. V. 9, No. 234, Aug. 1, 1987, p. 1.
[31]Mining Magazine. V. 158, No. 2. Feb. 1988, p. 1.
[32]Industrial Minerals. No. 248. May 1988, p. 77.
[33]By Gordon L. Kinney, physical scientist, Division of International Minerals.
[34]Hanoi Nhan Dan in Vietnamese, July 23, 1987, p. 3.
[35]———. Editorial: Intensive Investment, Creation of Stability for Cement Production. Jan. 14, 1988, p. 1.
[36]Ha Thi. Phosphate Fertilizer for Agriculture—Long Wait for Imported Raw Materials, Big Losses During Shipping. Hanoi Nong Nghiep (in Vietnamese), Dec. 5, 1987, p. 4.
[37]Hanoi Vietnam Courier (in English). Feb. 1988, p. 3.

Table 13.—Vietnam: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal destinations, 1986
METALS			
Aluminum: Metal including alloys, all forms	94	17	All to Hong Kong.
Chromium: Ore and concentrate	1,664	198	All to Japan.
Copper: Metal including alloys, all forms	4,605	1,175	All to Hong Kong.
Iron and steel: Metal:			
Scrap	55,477	82,936	All to Japan.
Semimanufactures	140	2,068	All to Thailand.
Tin: Metal including alloys, unwrought	13	70	Japan 50; Hungary 20.
INDUSTRIAL MINERALS			
Diamond: Industrial stones, value, thousands	$28	--	
Mica: Crude including splittings and waste	10	--	
Precious and semiprecious stones other than diamond: Natural, value, thousands	$14	$42	All to Italy.
Salt and brine	1,674	310	All to Hong Kong.
Stone, sand and gravel:			
Dimension stone, all forms	66	1,433	Hungary 1,432.
Sand excluding metal-bearing	390	--	
MINERAL FUELS AND RELATED MATERIALS			
Coal: Anthracite and bituminous	198,800	131,093	Japan 93,624; Belgium-Luxembourg 20,112; France 11,075.

[p]Preliminary.
[1]Table prepared by Audrey D. Wilkes. Owing to a lack of official trade data published by Vietnam, this table should not be taken as a complete presentation of this country's mineral exports. These data have been compiled from United Nations information and data published by the trading partner countries. The United States did not report any imports of mineral commodities from Vietnam during 1986.

Table 14.—Vietnam: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal sources, 1986
METALS			
Aluminum: Metal including alloys, all forms	322	1,216	Hungary 942; Japan 233.
Chromium: Oxides and hydroxides	(2)	22	All from Japan.
Cobalt: Oxides and hydroxides	--	13	Hong Kong 10; Japan 3.
Copper: Metal including alloys, all forms	127	522	Poland 301; Hong Kong 169.
Iron and steel: Metal:			
Pig iron, cast iron, related materials	90	--	
Ferroalloys	250	483	Japan 376; France 97.
Steel, primary forms	--	9	France 6.
Semimanufactures:			
Bars, rods, angles, shapes, sections	14,124	10,616	Poland 6,810; Japan 1,970; Sweden 868.
Universals, plates, sheets	9,640	9,655	Japan 6,311; Poland 1,372; Hungary 805.
Hoop and strip	524	588	Japan 497; Belgium-Luxembourg 61.
Rails and accessories	41	23	All from United Kingdom.
Wire	1,516	1,028	Japan 981; Sweden 27.
Tubes, pipes, fittings	357	11,404	Japan 10,644; Sweden 495.
Lead:			
Oxides	7	20	All from Japan.
Metal including alloys, all forms	208	54	Hong Kong 50.
Magnesium: Metal including alloys, all forms	1	--	
Manganese: Oxides	113	194	Hong Kong 144; Japan 50.
Nickel: Metal including alloys, all forms	5	7	Sweden 4; Japan 3.
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$16	$93	Japan $92.
Titanium: Oxides	73	463	Hong Kong 245; Japan 218.
Tungsten: Metal including alloys, all forms kilograms	--	52	All from Japan.
Zinc:			
Oxides	48	586	Hong Kong 528; Japan 58.
Metal including alloys:			
Unwrought	190	300	All from Poland.
Semimanufactures	1	--	
Other: Ores and concentrates	25	--	
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc	--	89	All from Netherlands.
Artificial:			
Corundum	4	31	All from Hungary.
Silicon carbide	4	--	
Grinding and polishing wheels and stones	1	3	All from Japan.
Asbestos, crude	5	105	All from Canada.
Cement	8,163	3,765	Hong Kong 2,748; Philippines 1,000.
Clays, crude	--	8	All from Sweden.
Diatomite and other infusorial earth	(3)	60	All from Japan.
Fertilizer materials: Manufactured:			
Ammonia	72	13	Do.
Nitrogenous	578,534	229,600	U.S.S.R. 217,600; Bulgaria 12,000.
Phosphatic	--	10,000	All from Philippines.
Potassic	79,673	81,603	U.S.S.R. 81,600.
Unspecified and mixed	11,531	366	Japan 220; Sweden 146.
Gypsum and plaster	--	1	All from Italy.
Magnesium compounds: Oxides and hydroxides	20	20	All from Hong Kong.
Mica: Worked including agglomerated splittings	--	3	All from Japan.
Pigments, mineral: Iron oxides and hydroxides, processed	--	76	Japan 75.
Pyrite, unroasted	38,000	60,000	All from U.S.S.R.
Sodium compounds, n.e.s.:			
Carbonate, natural and manufactured	9,867	4,980	France 2,500; Japan 2,260.
Sulfate, natural and manufactured	3,839	3,128	Hong Kong 3,124.
Stone, sand and gravel: Dimension stone, all forms	480	40	All to Italy.
Sulfur:			
Elemental, all forms	13,058	7,020	Poland 7,000.
Sulfuric acid	112	5	Mainly from Hong Kong.
Talc, steatite, soapstone, pyrophyllite	16	2	All from France.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,711	--	
Carbon black	302	459	Japan 356; Hong Kong 75.
Coal: Anthracite and bituminous	28,955	30,844	All from Australia.
Coke and semicoke	5,850	2,400	All from Japan.

See footnotes at end of table.

Table 14.—Vietnam: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[p]	Principal sources, 1986
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum refinery products:			
Gasoline 42-gallon barrels	145	--	
Mineral jelly and wax do	3,502	2,267	Hong Kong 1,747; Japan 394.
Kerosene and jet fuel do	81,321	19,656	Italy 19,631.
Distillate fuel oil do	1,612,143	119	Finland 67; West Germany 52.
Lubricants do	201,239	39,242	Italy 32,998; Japan 4,196.
Residual fuel oil do	897,362	--	
Bitumen and other residues do	16,374	3,531	Hong Kong 2,727; Finland 788.
Bituminous mixtures do	588	12	All from Japan.

[p]Preliminary.

[1]Table prepared by Audrey D. Wilkes. Owing to a lack of official trade data published by Vietnam, this table should not be taken as a complete presentation of this country's mineral imports. These data have been compiled from United Nations information and data published by the trading partner countries. The United States did not report any exports of mineral commodities to Vietnam during 1986.

[2]Unreported quantity valued at $2,000 exported by France.

[3]Unreported quantity valued at $3,000 exported by Japan.

The Mineral Industry of Other Near East Countries

By Michael D. Fenton[1] and Charles L. Kimbell[2]

CONTENTS

AFGHANISTAN[3]

Detailed comprehensive assessment of the performance of Afghanistan's mineral industry during 1987 is virtually impossible, owing to the paucity of reliable published information. It was evident, however, that the level of civil disorder, now in its eighth year since the arrival of significant numbers of Soviet troops, was in actuality little removed from open civil war. Insurgents controlled substantial areas of the country and imperiled any industrial activity in many places. Assistance programs by the U.S.S.R. and other Eastern European nations were directed at developing the country's meager mineral industry, but the economy was generally viewed as chaotic.

The inflation rate was somewhere between 20% and 30%; major food shortages contributed to the discontent of the population, and numerous villages were devastated by Soviet and Afghan Government campaigns to destroy the insurgents and cut their supply routes. Moreover, proposals by the Soviets and the Kabul Government aimed at reducing tensions with the rebels and scaling down the warfare seemingly were taken by the opposition as signs of weakening by the Soviet-backed Government, and rather than reducing aggressions, seemed to heighten insurrectionist activities. Efforts to entice the substantial number of Afghans who have fled to nearby areas of Pakistan and Iran to return to their country seemingly were failures, and indications near yearend that the Soviet Union might soon begin withdrawal of its occupation force of nearly 120,000 did little if any to reduce disorder.

Evidence of mineral industry development during the year was sparse, in contrast to some prior years. It was reported that a contract was signed between the Afghan and Soviet Governments for the development of a new gasfield in northern Afghanistan. Technical details of the project were not reported; thus it was difficult to assess the significance of its reported cost of 21 million rubles in terms of U.S. currency. (Reportedly, it was suggested that this represented $33.7 million. This would indicate an exchange rate of 1 ruble equals $1.60—a figure clearly too high.) Of the

total project value, the Soviets were to provide 15 million rubles; the balance was to be provided by the Afghans. It further was not made clear if this project was intended to augment output from fields already established and in operation, or if it is intended to partly or totally replace these established operations. However, it may be significant to note that reported Soviet imports of natural gas from Afghanistan declined from 77,445 million cubic feet (MMcf) in 1986 to only 57,880 MMcf in 1987, a drop of slightly over one-fourth. This shortfall, of course, could be the result of either the depletion of some wells or an interrruption in pipeline flow (stemming from either insurgent activity or technical problems), or some combination of these.

There has been no clear evidence that the Ainak copper mine and beneficiation plant and the associated smelter at Kabul have yet come into commercial production, although they have been repeatedly described as being completed in late 1985. In fact, the meager information available suggests that smelting operations probably did not begin. The smelter product was to be delivered to the Soviet Union in repayment for the development and construction costs, but an examination of the official Soviet statistics on imports from Afghanistan shows no entry for copper imports in either 1986 or 1987, and, moreover, no significant unidentified value, at least in 1986, that could represent the value of copper shipped, even though not specifically identified. In 1987, there was a value of 18.5 million rubles of Soviet imports that were not specifically accounted for by commodity, and it is possible that some or all of this was for smelter copper.

If and when Ainak comes into production, an annual output ranging between 25,000 and 38,000 tons of smelter copper is expected from ore reserves of 360 million tons grading 0.7% copper to 1.5%. Because of the lack of evidence of commercial production, smelter output in the accompanying production table has been revised to zero, and mine output has been reduced to a minimal and nominal estimate, reflecting only a modest level of development work.

Of other projects, there were no reports, suggesting, at least, that there was little if any progress, probably owing largely to insurgent activities. The project to provide a rail link between the U.S.S.R. and Kabul, development work for the Hajigak iron ore deposits, and a myriad of programs for investigations of deposits of a variety of other minerals were conspicuously not mentioned.

Afghanistan's 1987 energy requirements presumably were not far from the 1986 level of about 1.67 million tons of standard coal equivalent (SCE). Of this consumption level, domestically produced natural gas provided almost precisely one-half, domestically mined coal about 10%, domestically generated hydropower about 5%, and the remaining 35% was met by liquid fuels, all imported except for a tiny domestic production of natural gas condensate and other natural gas plant liquids. In terms of SCE, Afghanistan's natural gas output, at 3.8 million tons in 1986, far exceeds total annual energy demand, but by far the largest share of the gas—nearly 80% in 1986—was exported to the Soviet Union. Thus, although energy production far exceeds demand in terms of total quantities, Afghanistan remains dependent upon liquid fuel imports to meet over one-third of its total energy requirement, this chiefly to meet the needs of transportation and small geographically isolated industrial establishments.

Table 1.—Other countries of the Near East: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Country and commodity	1983	1984	1985	1986[p]	1987[e]
AFGHANISTAN[2]					
Barite[e]	2,000	2,000	2,000	2,000	2,000
Cement, hydraulic[e]	13,000	112,000	77,000	[r]85,000	100,000
Coal, bituminous	[r]145,000	[r]148,000	151,000	160,000	150,000
Copper:[e]					
Mine output, Cu content	--	--	[r]5,000	[r]5,000	5,000
Smelter	--	--	--	(3)	--
Gas, natural:					
Gross[e] million cubic feet	100,000	106,000	111,000	[r]111,000	112,000
Marketed do.	90,016	[r]95,859	100,655	100,840	101,000
Gypsum[e]	3,000	3,000	3,000	3,000	3,000
Natural gas liquids[e] thousand 42-gallon barrels	[r]81	[r]81	93	81	80
Nitrogen: N content of ammonia	8,000	[4]41,000	45,000	[r]40,000	40,000
Salt, rock[e]	10,000	10,000	10,000	10,000	10,000

See footnotes at end of table.

Table 1.—Other countries of the Near East: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Country and commodity	1983	1984	1985	1986[p]	1987[e]
BAHRAIN					
Aluminum metal: Primary, smelter	171,700	177,300	176,371	178,188	[4]180,334
Gas, natural:					
Gross million cubic feet	139,325	145,152	224,475	256,230	257,000
Marketed do	96,321	130,000	177,755	200,020	200,600
Natural gas liquids:					
Butane thousand 42-gallon barrels	914	864	772	894	900
Propane do	996	1,010	976	889	900
Naphtha do	1,209	1,251	1,206	1,169	1,200
Petroleum:					
Crude do	15,164	15,289	15,301	15,484	[4]15,300
Refinery products:					
Gasoline do	4,993	[e]6,100	6,892	7,520	7,500
Jet fuel do	9,984	[e]12,500	11,434	9,613	9,600
Kerosene do	1,096	[e]2,000	2,446	7,023	7,000
Distillate fuel oil do	16,848	[e]21,500	19,734	26,693	26,700
Residual fuel oil do	16,344	[e]17,000	15,378	22,611	22,600
Other do	10,881	[e]12,100	11,862	16,100	16,100
Total do	60,146	71,200	67,746	89,560	89,500
Sulfur, byproduct of petroleum do	49,275	47,300	42,300	50,070	50,000
LEBANON[2]					
Cement, hydraulic thousand tons	1,500	1,250	1,000	NA	NA
Gypsum	[e]5,000	5,000	3,000	NA	NA
Iron and steel: Metal, semimanufactures thousand tons	[e]100	100	90	NA	NA
Lime[e] do	20	20	10	NA	NA
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	[e]2,300	935	3,200	2,566	[4]2,015
Jet fuel do	[e]300	107	NA	218	[4]92
Kerosene do	[e]50	50	600	129	[4]151
Distillate fuel oil do	[e]2,000	1,417	3,200	2,234	[4]1,723
Residual fuel oil do	[e]3,500	2,664	5,800	4,549	[4]3,388
Liquefied petroleum gas do	[e]175	NA	335	194	[4]141
Other do	[e]125	NA	NA	153	[4]35
Refinery fuel and losses do	[e]400	NA	NA	735	[4]510
Total do	[e]8,850	5,173	13,135	10,778	[4]8,055
Salt[e] thousand tons	5	5	5	NA	NA
OMAN					
Cement, hydraulic	[e]2,200	477,000	648,501	[r e]700,000	[4]839,796
Chromite, gross weight	[e]24,000	7,000	--	4,820	6,000
Copper:					
Mine output, Cu content	11,300	16,200	17,700	18,200	[4]18,121
Smelter	7,600	21,300	18,800	19,601	19,500
Refinery	3,800	15,100	14,300	14,561	[4]15,490
Gas, natural:					
Gross million cubic feet	52,000	[r]137,000	140,000	162,060	162,000
Marketed do	23,500	[r]66,300	78,000	76,000	76,000
Natural gas liquids: Butane and propane thousand 42-gallon barrels	1,200	1,200	1,200	1,200	1,200
Petroleum:					
Crude do	[r]141,900	[r]152,400	181,800	204,100	188,000
Refinery products:					
Gasoline do	2,550	[r]2,996	3,243	3,585	3,500
Jet fuel do	880	[r]1,431	1,462	1,476	1,400
Kerosene do	78	78	[e]78	[e]78	70
Distillate fuel oil do	2,312	[r]3,517	3,930	3,880	3,800
Residual fuel oil do	1,199	[r]7,605	8,570	9,363	9,300
Other do	200	[r]772	809	938	900
Total do	7,219	[r]16,399	18,092	19,320	18,970
Sand and gravel thousand tons	3,410	6,420	[e]6,642	7,514	[4]7,590
Stone:					
Marble do	33	37	[e]37	44	[4]39
Other do	4,572	4,224	[e]4,000	2,875	[4]247
Sulfur, pyrites	[e]11,000	31,000	31,000	31,000	30,000

See footnotes at end of table.

Table 1.—Other countries of the Near East: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Country and commodity	1983	1984	1985	1986[p]	1987[e]
QATAR[2]					
Cement, hydraulic thousand tons	375	326	318	308	303
Gas, natural:					
Gross million cubic feet	[r]202,136	[r]215,905	214,480	229,100	[4]227,395
Marketed do	[r]171,800	[r]197,800	187,300	[r e]199,300	198,000
Iron and steel: Metal, semimanufactures thousand tons	469	488	510	493	[4]503
Natural gas liquids thousand 42-gallon barrels	[r]13,038	[r]16,594	12,789	[r e]13,600	13,500
Nitrogen: N content of ammonia	480,800	518,000	524,800	544,100	[4]560,800
Petroleum:					
Crude thousand 42-gallon barrels	107,675	[r]147,100	111,800	102,000	[4]106,945
Refinery products:					
Gasoline do	1,097	1,700	2,169	2,130	2,200
Jet fuel do	[e]488	[e]640	723	710	800
Kerosene do	[e]31	[e]30	27	[e]30	40
Distillate fuel oil do	1,387	2,100	3,070	3,100	3,200
Residual fuel oil do	[e]1,465	[e]1,500	4,071	4,200	4,300
Other do	73	72	558	696	800
Total do	4,541	6,042	10,618	10,866	11,340
Stone: Limestone thousand tons	[e]1,600	1,500	1,100	900	900
Sulfur	19,000	33,264	36,500	[r e]37,000	[4]35,000
SYRIA					
Cement, hydraulic do	3,626	4,279	4,296	4,200	[4]3,870
Gas, natural:[e]					
Gross million cubic feet	[4]16,729	[4]17,922	[r]18,000	[r]18,000	18,000
Marketed do	2,344	4,556	[r]5,400	[r]5,400	5,400
Gypsum	[r]78,750	[r]79,580	160,250	160,000	[4]248,000
Iron and steel: Steel, crude thousand tons	80	69	[e]69	[e]69	69
Nitrogen: N content of ammonia	113,400	[r]11,584	132,450	136,984	[4]92,533
Petroleum:					
Crude thousand 42-gallon barrels	61,320	60,400	61,000	68,000	[4]84,570
Refinery products:					
Naphtha do	4,672	5,329	NA	NA	NA
Gasoline do	6,242	7,190	NA	NA	NA
Kerosene and jet fuel do	3,285	3,212	NA	NA	NA
Distillate fuel oil do	46,757	52,889	NA	NA	NA
Liquefied petroleum gas do	1,314	1,606	NA	NA	NA
Asphalt do	2,336	2,409	NA	NA	NA
Other do	1,533	1,716	NA	NA	NA
Total do	66,139	74,351	NA	76,650	NA
Phosphate rock thousand tons	1,229	1,514	1,270	1,606	[4]1,986
Salt do	87	87	[e]87	[e]87	[4]81
Stone, sand and gravel:					
Stone: Dimension, marble cubic meters	71,000	71,000	[e]71,000	[e]71,000	[4]15,062
Sand and gravel thousand tons	5,780	5,829	[e]6,000	[e]6,000	6,000
Sulfur, byproduct of petroleum and natural gas do	30	[r]35	[r]35	[4]120	120
PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN					
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	2,000	2,000	[e]2,000	[e]2,000	2,000
Jet fuel do	1,600	1,700	[e]1,700	[e]1,700	NA
Kerosene do	1,100	1,200	[e]1,200	[e]1,200	NA
Distillate fuel oil do	6,000	6,300	[e]6,300	[e]6,300	NA
Residual fuel oil do	11,000	11,000	[e]11,000	[e]13,500	NA
Other do	200	230	[e]230	[e]900	NA
Total do	21,900	22,430	[e]22,430	[e]25,600	29,200
Salt[e] thousand tons	75	75	75	75	75
YEMEN ARAB REPUBLIC[2]					
Cement do	[r]850	[r]1,390	1,400	1,160	[4]760
Gypsum	23,138	24,295	25,000	53,000	[4]150,000

See footnotes at end of table.

Table 1.—Other countries of the Near East: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Country and commodity	1983	1984	1985	1986[p]	1987[e]
YEMEN ARAB REPUBLIC[2] —Continued					
Petroleum:					
Crude ------ thousand 42-gallon barrels	--	--	--	2,700	7,800
Refinery products:					
Gasoline ------ do	--	--	--	811	[4]1,103
Diesel fuel ------ do	--	--	--	870	[4]1,123
Fuel oil ------ do	--	--	--	929	[4]1,128
Total ------ do	--	--	--	2,610	[4]3,354
Salt	[e]141,000	[e]148,000	150,000	300,000	[4]163,000

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

[1]Table includes data available through Aug. 30, 1988.

[2]In addition to the commodities listed, asbestos, lapis lazuli, and uranium (in Afghanistan) and a variety of other crude construction materials (clays, sand and gravel, and stone) presumably are 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.

BAHRAIN[4]

More than 75% of Bahrain's export earnings come from the sale of crude oil and refined products. The momentum generated during the successful first year of the 1986-91 5-year development plan for oil and gas declined slightly. Average crude oil production during the first 8 months was down slightly to 42,000 barrels per day (bbl/d) from 42,422 bbl/d over the same period in 1987. Only 13 wells were drilled during the first 8 months of 1987, compared with 20 wells drilled in 1986. Also, only 12 wells were overhauled, compared with 36 wells in 1986.

Associated gas production in 1986 was 51.3 billion cubic feet, down slightly from the previous year's 51.4 billion cubic feet. Bahrain National Gas Co. (Banagas) expected 1987 production to be higher as a result of an investment program to upgrade gas handling facilities. Nonassociated gas production from the Khuff Gasfield declined slightly to 691 million cubic feet per day (MMcfd) during January-August 1987, from the 1986 average of 702 MMcfd. Banagas sold gas to Gulf Petrochemical Industries, Aluminium Bahrain (Alba), and the Bahrain Petroleum Co. (Bapco) oil refinery, and the gas was used for liquefied petroleum gas (LPG) production, power generation, and reinjection for pressure maintenance.

Saudi Arabia announced in early 1987 that it would credit 75,000 bbl/d of oil to Bahrain as compensation for the shutdown of the offshore Abu Safah Field, in which both countries share 50-50 in production. Saudi Arabia's Arabian-American Oil Co. had marketed production from the field and split the proceeds with Bahrain.

Banagas appointed a consultant for a project to expand its LPG installation. Two compressor stations would be added to the present four, and a 110-MMcfd processing train would be installed in the central gas plant. Storage would be added at Sitra terminal to handle the additional butane and propane, while naphtha would continue to go to the Bapco refinery. Capacity at the Jebel Dukhan plant would be increased by up to 65%, to 280 MMcfd. The original capacity of 110 MMcfd was expanded to 170 MMcfd in 1986.

Banagas' 1986 revenue fell by 45% below that of 1985 to $31.6 million as a result of the 1986 slump in oil products prices, but rose again in 1987 by 19% to $37.6 million. In 1986, 1 MMcf of gas yielded 56 barrels of LPG, whereas in 1987, the yield was 60 barrels. Naphtha, propane, and butane production rose slightly from 2.9 million barrels in 1985, to 3.1 million barrels in 1986, and to 3.2 million barrels in 1987.

Bapco continued planning to modernize the Sitra Island refinery. Bapco's capital cost estimate to modernize the 50-year-old plant rose to $1.2 billion. The detailed feasibility study was expected to be completed within a year. There was also interest in improving wharves at Sitra to handle vessels larger than the current 100,000-

deadweight-ton capacity.

Alba produced more than 180,000 tons of primary aluminum metal in 1987, which was about 10,000 tons above rated capacity. Production of finished products for 1986 and 1985 was 178,194 tons and 174,825 tons, respectively. Total sales rose by 58% over that of 1986 to 228,310 tons. Net profit of the Bahrain Saudi Aluminium Marketing Co. (Balco), which markets the Bahraini and Saudi Arabian Governments' share of Alba production, was $60.3 million in 1987 on sales of 143,000 tons of aluminum products. Nearly 60% of production went to nearby gulf coast states, and 35% went to downstream fabricating plants in Bahrain. During 1986, Balco's profits were only $27.6 million, and 181,850 tons of metal was exported, an increase of 40% over 1985 exports. The profit increase was attributed by Balco partly to an increase in the price of aluminum from a low of $950 per ton in 1986 to $1,700 per ton by late 1987. Also, sales included a higher proportion of valued-added products, such as rolling ingot and extrusion billets, compared with earlier sales of commercial-grade metal and standard ingots.

In 1986, Balco had about 90 customers in 20 countries. Increased local sales in 1987 caused Balco to pull out of some world markets for lack of available metal.

The continuing expansion program at Alba, which would raise annual aluminum capacity from 170,000 tons to 225,000 tons, included the extension of potline 3 (potrooms 5 and 6) by 76 hooded, point-fed, and computer-controlled pots and the reequipping of potlines 1 and 2. Eight contractors bid for the $40 million job of supplying and installing five waste-heat boilers and a 60-megawatt steam turbine generator with air-cooled condenser. Bids were invited for an alumina handling contract to increase on-site alumina capacity to 55,000 tons from 30,000 tons and capacity at the Alba terminal to 60,000 tons from 35,000 tons. In anticipation of an increase in alumina requirements that would accompany the expansion, Alba made its first purchases from India's National Aluminium Co.

Although Gulf Aluminium Rolling Mill Co. (Garmco) reported a net loss of $12.7 million during 1986, the first full year of operation, it exceeded targeted output by 22%. Garmco expected to be making a profit by 1988. Plans for a 6,000-ton-per-year aluminum foil plant to be built next to Garmco's mill were behind schedule.

Shareholders of Arab Iron and Steel Co. (Aisco) voted to liquidate the company in anticipation of a takeover by Kuwait Petroleum Corp. Creditor banks accepted a proposal that the company would pay 48% of the $200 million in outstanding debts associated with the inoperative $160 million, 4-million-ton-per-year plant. Resolution of the debt problem may lead to the construction of a $260 million hot-briquet iron plant that would use Aisco's pellets to produce briquets of direct-reduction iron having a much higher value than pellets currently on the world market. Midrex of the United States was commissioned in mid-1986 to do a feasibility study, and a marketing study of the plant's proposed annual output of 1 million to 2 million tons was in progress by Kuwait-based Gulf Investment Corp. Aisco's failure was blamed on poor quality feedstock and the Iran-Iraq war that hurt sales.

LEBANON[5]

Lebanon entered its 13th year of civil war in the spring, and the economic condition of the country reached a new low as inflation, unemployment, poverty, and hunger affected the population. The annual inflation rate exceeded 500%, and Lebanon's ratios of budget deficit and public debt to national income were among the highest in the world. Wage earners could barely support themselves; both the confederation of labor unions and the teachers union went on strike for salary increases and social benefits to compensate for the drop in real income. In addition, fuel shortages caused bread and electric power shortages, because most bakeries and powerplants were fueled by diesel oil.

The catastrophic collapse of the Lebanese pound brought the exchange rate down from 63 to the U.S. dollar at the beginning of the year to more than 500 by early November. Concurrently, Government revenues declined by yearend to less than $1 million while Government expenditures exceeded $500 million. Collected customs receipts were flowing into the coffers of the various militias controlling the ports. A plan to sell some of Lebanon's estimated $4

billion worth of gold reserves to raise income for credit and subsidies was deferred because of fear that this would erode remaining confidence in the Lebanese financial system.

The Ministry of Industry and Petroleum maintained complete control over the petroleum sector, including importing, refining, and setting retail prices. Much of the Government's spending went to subsidize fuel at artificially low prices, which resulted in the smuggling of inexpensive fuel to neighboring states. To alleviate this problem, the Government eased the gasoline subsidy for an annual savings to the Government of about $100 million.

The Government operated two oil refineries, Tripoli Oil Installations in north Lebanon and Zahrani Oil Installations in the south. It kept storage facilities in Dora, east Beirut, and Amcit, north Beirut. The refineries normally provide 40% to 45% of Lebanon's needs. Crude oil was imported from Iraq in tankers, and gasoline and gas oil were imported in tankers from Bulgaria. Jet fuel came from Greece, Italy, and Malta. Gasoline and gas oil were also imported illegally.[6] Jet fuel, lubricants, petrochemical feedstocks, and waxes were imported by private petroleum distribution companies or individuals. In Jiyeh, south Lebanon, entrepreneurs built seven reservoirs: three to store gasoline, two for gas oil, and two for asphalt.

Lebanon had two factories producing asphalt for local consumption: an old factory in Tripoli, and one established in September 1987 between Sidon and Tyre. Lebanon's major petrochemical industry was plastics processing, including plastic sheets, wrapping, containers, sanitary articles, and tiles.

OMAN[7]

The petroleum industry dominated the economy of the Sultanate of Oman in 1987, providing 90% of export earnings (97% if reexports are not included) and more than 80% of Government revenues. For this reason the economy recovered significantly as oil prices rose from about $10 per barrel during mid-1986 to about $18 per barrel in 1987. Nevertheless, the third 5-year development plan (1986-90), which was based on oil prices of $22 to $23 per barrel, had to be revised, and a new plan was released in December 1987. The Government then reintroduced fixed-price contracts for oil, with the price set at $17.63 for the rest of 1987. Revenues increased to a projected $3.47 billion in 1987 compared with $3.17 billion in 1986. A budget deficit of $0.7 billion was forecast for 1987, significantly less than the $1.7 billion actual deficit of 1986. The 1988 budget indicated a deficit of nearly $0.7 billion and revenues of $3.5 billion including oil income of $2.8 billion and natural gas income of $112 million. The Government expected the gross domestic product (GDP) to increase by 2.5% per year for the rest of the decade.

At the beginning of 1987, Oman announced a cut in oil production and export in support of similar cuts by members of the Organization of Petroleum Exporting Countries (OPEC). Production would be reduced to about 520,000 bbl/d from 550,000 bbl/d. Only 468,000 bbl/d would be exported, rather than the previous average of 500,000 bbl/d. However, by mid-1987, output rose to 600,000 bbl/d, and by yearend, it was 565,000 bbl/d. The country's production capacity was 720,000 bbl/d. During 1986, Japan took 273,000 bbl/d, nearly 9% of its consumption requirements. A similar amount went to Japan in 1987. The Republic of Korea, Taiwan, Thailand, and Singapore also were buyers.

Omani crude oil reserves were about 4 billion barrels, more than one-half being in the northern oilfields of Fahud, Yibbal, Natih, al-Huwaisah, Lekhwair, and Shibkah. Oil deposits were relatively small, and widely scattered, unlike the huge reservoirs of easily extracted oil found elsewhere in the Arabian Peninsula. In 563 of the 736 wells producing during 1986, enhanced-recovery techniques of water, steam, and polymer injection were required to extract oil.

Petroleum Development Oman (PDO), which produced 98% of Oman's oil from 720 wells in 36 fields at the beginning of 1986, continued exploration and development at an active pace during 1987. PDO brought into production nine new fields, which could reach a total output of 69,000 bbl/d. Occidental Oil Co. of Oman drilled 22 wells, raising its production from 3,000 bbl/d to 9,000 bbl/d during the year. Elf Aquitaine of Oman drilled one new well at Sahmah and worked over old wells while producing about 6,500 bbl/d. Japex Oman Ltd. continued its appraisal of several wells drilled in

the Mazoon and Daleel structures, while Consolidated International Petroleum Corp. (CIPC) failed to confirm the high potential of an offshore structure with its West Bukha-1 wildcat well. The first developmental phase of Nimr Field was completed by PDO, which included the production centers Nimr A, B, and C, and Karim West, as well as the Amal gathering stations. The temporary facilities at the Zauliyah and Sukweihat Fields were replaced by permanent production installations. Development wells were drilled at the Fahud, Natih, and Yibal Fields in north Oman, and at Bahja, Nimr, and Thuleilat in the south. The experimental water injection system at Lakhwair was expanded.

PDO was testing a new discovery of 29° to 30° API light crude at Qarat al-Milh well, located about 15 kilometers north of North Ghaba in central Oman. The significant new discovery was in the deep Hausi formation, rather than the shallower Natih and Shuaiba Reservoirs that account for most of the hydrocarbon production in the area. Two of three oil-bearing zones in the formation tested 1,000 bbl/d. A small amount of light oil was also discovered in the Hausi formation at Alam, about 20 kilometers east of Qarn al-Alam.

PDO signed its first offshore concession agreement for 25,600 square kilometers in the Arabian Sea off southern Oman. A marine seismic survey was scheduled to begin in January 1988 in the area that was once held by Amoco Corp. of the United States. The three-block concession was split between an area off Salalah, near the Kuria Muria Islands, and an area south of Masirah Island. PDO also acquired a 48,600-square-kilometer onshore area in the southern Dhofar area.

PDO cut its capital expenditure budget to $1.1 billion, 26% below the level of actual spending in 1985. All new projects for installing enhanced recovery systems were deferred until the mid-1990's following a reassessment of the projected expenses. Projects in progress would be completed, however, at Marmul, Qarn Alam, Rahab, Amal, Mukhaizna, and Nimr Fields. Completions were expected by October 1988.

Oman had recoverable reserves of 2.5 trillion cubic feet (Tcf) of associated gas and 6.9 Tcf of nonassociated gas. In 1986, associated gas production averaged 261 MMcfd. Nonassociated gas production was 126 MMcfd. Flaring has been reduced over several years from 55% to 15%. During 1985, the Government Gas System, operated by PDO, sold 23.7 billion cubic feet to electric powerplants, 3.7 billion cubic feet to the Oman Mining Co., and 2.2 billion cubic feet to the Oman Cement Co.

The Government continued to make considerable progress in exploiting its natural gas resource. The Kuwaiti-based Arab Fund for Economic and Social Development agreed to provide a loan to partly finance phase 4 of the gas system expansion, which would increase availability of natural gas for electricity generation and water desalination, among other uses, at a cost of $105.2 million. Phase 4 involves the construction of a 180-kilometer, 36-inch gasline from the Yibal Field to Izki, the drilling in Yibal of four nonassociated gas wells, and the construction of gas-gathering and treatment plants and other facilities, including a terminal at Barka. Also, the Ministry of Petroleum and Minerals awarded a $715,000 contract for the study of gas demand, supply, and estimated production targets over the next 40 years.

CIPC awarded a contract to Brown & Root Inc. (United Kingdom) to do basic engineering studies on the Bukha Gasfield offshore from the Musandam Peninsula. The number of platforms needed and where the gas should be brought ashore would be determined by the study. Bukha could provide up to 60,000 bbl/d of natural gas liquids and at least 400 MMcf of dry gas per day. Possible consumers are the smelter planned by Umm al-Qaiwain Aluminium Co., and a fertilizer plant at Sohar. CIPC also acquired a 770-square-kilometer concession offsetting the Bukha Field concession.

The capacity of the main export pipeline from Fahud to the Mina al-Fahal terminal was increased to 725,000 bbl/d and was to be further increased to 915,000 bbl/d by the connection of additional spur lines. A major gas-gathering system was being developed for the associated gas in order to conserve nonassociated gas. The utilization rate of associated gas was 85% at yearend.

The capacity of Oman's single refinery, operated by Oman Refinery Co. (ORC) in Mina al-Fahal, was increased to 80,000 bbl/d by Mitsui Engineering and Shipbuilding Co. at a cost of $25 million. The reason was to meet rising domestic consumption that had been growing at about 14% annually. ORC was studying a proposal to use currently flared gas for power generation. Five gas turbines, each with a capacity of 2.5 megawatts, were proposed. ORC used 6

to 7 megawatts, and it could supply power to the Mina al-Fahal industrial and residential complex. All refined products were sold to BP Arabian Agencies Ltd. and Shell Markets (Middle East) Ltd., the sole distributors in Oman. The heavy residue was sold to Singapore refineries with cracking capabilities.

Oman's mining industry was based primarily on copper mining and refining facilities at Sohar, 250 kilometers north of Muscat. The Lasail and Bayda underground mines produced ore grading 1.7% copper at a rate of 14,000 to 15,000 tons of copper per year. Total reserves, including the Aarja deposit, were about 12 million tons averaging 2.1% copper, and the design capacity of the smelter and refinery was 20,000 tons per year. Amalgamated Metals Corp., United Kingdom, continued to take 12,000 tons, mainly for European customers.

Oman Mining Co. was reported to have been producing about 6,000 tons of chromite per year for export from a capacity of about 20,000 tons per year. The Government announced that French companies would soon be mining several other chromite deposits. However, conflicting reports indicate that a contract for geological studies and resource assessment of 10 known chromite deposits was postponed temporarily until revenues from oil exports improve.

QATAR[8]

Qatar's oil reserve of about 3.3 million barrels was the smallest among member countries of OPEC, whereas its natural gas reserve of 157 Tcf represented about 4.5% of the world total and 12% of total OPEC gas reserves. This gas reserve was the fifth largest in the world, behind the reserves of the U.S.S.R., Iran, the United Arab Emirates, and the United States. Almost all of Qatar's gas reservoirs are in the North Field, 50 miles off Qatar's northeastern coast.

Despite efforts to increase the importance of Qatar's other producing sectors, petroleum still accounted for more than one-half of the GDP and 90% of revenue. The Qatari economy suffered in 1986 because of the steep decline in oil prices and weak demand for OPEC oil, but some real improvement in the economy occurred in 1987 as oil prices and demand rebounded. Oil revenues in 1987 reached an estimated $1.7 billion, compared to $1.6 billion in 1986, and $3.2 billion in 1985. The GDP improved from a 21% decline from 1985 to 1986 to a projected 5% increase from 1986 to 1987.

In May 1987, Qatar signed the long-awaited agreement with Bechtel Corp. of the United States and Technip of France to begin the first stage of the North Field gas project. All Qatari industries, and power and desalination plants, run on gas. The $950 million project would develop 800 MMcfd of natural gas that would be processed to about 730 MMcfd of dry gas for petrochemical, fertilizer, cement, and steel plants; power stations; the refinery; and seawater desalination plants. The liquids extracted from the North Field gas would be exported to earn about $160 million per year in 1987 dollars. The project would be financed 60% by international market funds, 20% by the Qatar Government, and 20% by oil payments to contractors. Financial adviser for the project was First Boston Corp. of the United States.

Although Qatar's OPEC production ceiling was 285,000 bbl/d during the first half of the year, production throughout the year was erratic. It was as low as 100,000 bbl/d in April, when the price of Qatari light crude was higher than spot market prices. In May, the Government yielded to market pressure and began discounting light crude prices. Production then rose beyond the 299,000-bbl/d OPEC quota set at the end of June. Production peaked at nearly 450,000 bbl/d in August but declined again to about 300,000 bbl/d in October. The Qatar General Petroleum Corp. (QGPC) reported that crude oil production averaged 293,000 bbl/d in 1987, of which 254,000 bbl/d was exported.

QGPC also reported that nonassociated gas production was 400 MMcfd, while associated gas production was 223 MMcfd; a combined 12% increase over 1986 production. Propane and butane production for the year was nearly 585,000 tons. Exports of LPG and natural gasoline were 634,000 tons and 204,000 tons, respectively; an increase of 20% over 1986 exports. Output of refined products increased by 14% to 1.6 million tons, while local consumption increased by 3%. Exports of diesel fuel and fuel oil reached 997,900 tons. Major buyers of petroleum were Japan, the United States, and Italy.

QGPC decided to increase the capacity of its Umm Said 50,000-bbl/d refinery by

12,000 bbl/d to meet growing demand. This refinery was connected to and operated as a single unit with a 12,000-bbl/d refinery to save on maintenance and production costs. Plans included renovating the distillation unit and upgrading the naphtha and kerosene hydrotreating plant, the platforming unit, and the oil and LPG plants. A new isomerization unit was to be installed to increase the octane level of gasoline.

Qatar Steel Co.'s (Qasco) production of direct-reduced iron (DRI) declined slightly to 470,000 tons, but exceeded the design capacity of 400,000 tons. DRI production was 490,000 tons during both 1985 and 1986. Steel bar semimanufactures were up 2% over that of 1986 to 503,000 tons. Fifteen percent of sales went to the domestic market, while the rest went to neighboring states, such as Saudi Arabia (more than 40%), Kuwait (20%), and the United Arab Emirates (20%). Qasco was still unable to report a profit for the year, but its financial performance was improved by administrative cost-cutting.

Qatar's industrial minerals industry included construction-based minerals such as clays, gypsum, and limestone for cement; recrystallized limestone for building aggregates; and silica sand. The Qatar National Cement Co.'s (QNCC) performance during 1987 was discouraging as a result of the availability of cheaper imports. QNCC produced 293,000 tons of clinker in 1987, 97.5% of its production goal, which was less than its 1986 production of 308,115 tons. Production of portland and sulfur-resistant cement was 126,521 tons. Unslaked lime output reached 14,652 tons and slaked lime production was 10,000 tons. Cement sales during the first half of the year were 63,378 tons, down 34% from sales in the same period in 1986. This decline followed a 31% drop from 1985 to 1986. Sales income was 20% below that of 1986, to $5.8 million. The company projected that profits for the year could decline to $2.7 million.

SYRIA[9]

The economy of Syria was severely depressed by structural causes and problems related to the decline in oil prices during 1986. The Government was heavily invested in the public sector industries, and the military dominated the expenditure budget, while oil income and aid from other neighboring states declined. With foreign exchange limited even state-owned enterprises experienced difficulty obtaining required imported commodities and spare parts to keep factories in operation. Certain commodities, such as oil, were high-priority items that were allotted the hard currency necessary for importation. Stagnant agricultural production, high inflation, and depreciating currency were additional problems. The Government adopted tight fiscal policies to control the budget deficit, and concentrated on developing agriculture.

At the end of 1987, Syria's proven oil reserves were estimated at more than 1.5 billion barrels, and gas reserves were nearly 4.4 Tcf. Oil production averaged 231,700 bbl/d during the year. The major new field in the Deir-ez-Zor area may eventually transform Syria into a net oil exporter.

The 5-year agreement between Iran and Syria was renewed to May 1988. Iran would supply the Syrian military with 1 million tons (about 7.5 million barrels) of free oil and 2 million tons of oil at a cash price of $17.50 per barrel. The reduction in oil supplied by Iran was an indication of Syria's lessening reliance on Iranian light oil. The Banias and Homs refineries were being supplied to an increasing extent by local oil.

Brown & Root Engineering and Construction Co. of Dubai, an affiliate of Brown & Root of the United States, won a $70 million contract to assist Al-Furat Petroleum Co. increase oil production from its Deir-ez-Zor concession in northeastern Syria. The 60,000 bbl/d of oil from Thayyim Field was to be supplemented by 40,000 bbl/d to be produced from al-Ward and al-Asharah Fields. Gathering lines from al-Asharah would be laid and oil would be transported under the Euphrates River to al-Ward, where gathering lines and basic processing facilities would be established. These new fields would be joined by a 43-mile, 16-inch pipeline to the line from Iraq to Banias on the Syrian coast, which was carrying 35.5° API gravity, low-sulfur crude oil to the Homs refinery from a 57-mile spur line from Thayyim field. At yearend, Tanak 1 well struck oil near Thayyim Field and tested at 1,500 bbl/d. Another well, at Tayni in the Deir-ez-Zor concession, tested at 5,800 bbl/d.

A Syria-Soviet Union joint committee for economic, scientific, and technical cooperation held its ninth session in Damascus in June, and the Syrian Government announced that it was seeking new ways for cooperation. The U.S.S.R. agreed to assist in the expansion of the Syrian phosphate and

petroleum industries in return for payment in phosphate rock deliveries. In 1987, the Soviet Union took 89,000 tons of phosphate rock, and exports may reach 6 million tons by the year 2000. Meanwhile, two Soviet survey ships prospected for oil and minerals off Latakia.

Turkey proposed talks about possible joint exploitation of about 3 Tcf of gas discovered by Marathon Oil Co. of the United States in the Homs area in Syria, and the building of an export pipeline. The refinery at Homs invited bids for a turnkey contract to build a plant that would process spent oils and produce lubricants. This plant would have only about one-third of the 700,000-barrel-per-year capacity that had been proposed earlier.

The General Co. for Phosphates and Mines (Gecopham) succeeded in increasing its production and export of phosphate rock in 1987 as it had in 1986. Output increased by 24% over that of 1986 to nearly 2 million tons, whereas exports increased 23% over that of 1986 to 1.6 million tons. Unfortunately, price levels remained low during the year. Significant sales increases occurred in France, and new markets were opened in Austria, Denmark, Greece, Portugal, and Spain. With the expectation of additional increases in foreign sales, investment in mining machinery continued, and phosphate export facilities at Tartous were expanded from 1.3 million tons per year to 2.4 million tons.

Czechoslovakia's Strojexport was given two minerals exploration contracts worth $16.8 million to conduct geophysical and geochemical surveys throughout Syria during the next 3 years.

Table 2.—Syria: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	Destinations (principal), 1984
METALS			
Aluminum: Metal including alloys, semimanufactures	1	--	
Cobalt: Oxides and hydroxides	13	--	
Copper: Metal including alloys:			
Unwrought	581	934	All to West Germany.
Semimanufactures	2	29	West Germany 27.
Iron and steel: Metal:			
Pig iron, cast iron, related materials	33	--	
Semimanufactures:			
Bars, rods, angles, shapes, sections	--	2	All to Saudi Arabia.
Universals, plates, sheets value, thousands	$1	--	
Rails and accessories	2	--	
Wire	14	--	
Tubes, pipes, fittings	15	9	Saudi Arabia 8.
Castings and forgings, rough	148	86	Saudi Arabia 68; Jordan 13.
Lead: Metal including alloys, semimanufactures	2	--	
Magnesium: Metal including alloys, unwrought	6	30	All to Lebanon.
Other: Ashes and residues	432	296	All to Jordan.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc	2	40	NA.
Grinding and polishing wheels and stones	1	--	
Barite and witherite	273	--	
Cement	--	1,220	All to Jordan.
Chalk	--	18	All to Saudi Arabia.
Clays, crude	407	272	Saudi Arabia 230; unspecified 42.
Fertilizer materials: Manufactured:			
Ammonia	65	92	Jordan 91.
Nitrogenous	5,548	26,100	Iran 20,000; Burma 6,000.
Phosphatic	15,700	300	All to Jordan.
Gypsum and plaster	30,565	181	Jordan 154; unspecified 27.
Magnesite, crude	--	30	All to Saudi Arabia.
Phosphates, crude thousand tons	1,002	951	Romania 305; U.S.S.R. 208; Bulgaria 125.
Pyrite, unroasted	--	150	All to Saudi Arabia.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	143	2,054	Lebanon 996; Saudi Arabia 850.
Worked	49	21	Saudi Arabia 12; Kuwait 4.
Dolomite, chiefly refractory-grade	--	1,428	All to Jordan.
Gravel and crushed rock	41,818	21,784	Kuwait 12,345; Saudi Arabia 6,268.
Sand other than metal-bearing	97	--	
Sulfur: Elemental: Colloidal, precipitated, sublimed	--	1	NA.
Talc, steatite, soapstone, pyrophyllite, etc	2	--	
Other: Crude	73	172	Lebanon 97; unspecified 75.

See footnotes at end of table.

Table 2.—Syria: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	Destinations (principal), 1984
MINERAL FUELS AND RELATED MATERIALS			
Coke and semicoke	5	--	
Petroleum:			
Crude thousand 42-gallon barrels	42,226	36,913	Romania 20,881; Italy 7,924.
Refinery products:			
Liquefied petroleum gas do	16	--	
Gasoline, motor do	715	119	All to Lebanon.
Kerosene and jet fuel do	116	271	All to Norway.
Residual fuel oil do	9,801	9,045	Italy 4,118; France 2,811; Tunisia 469.
Bituminous mixtures do	44	8	All to Libya.
Petroleum coke do	514	1,424	Turkey 1,423.

NA Not available.

[1]Table prepared by Virginia A. Woodson. Syria did not report exports of any mineral commodities to the United States during 1984.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals value, thousands	$18	$32	$28	United Kingdom $4.
Aluminum:				
Oxides and hydroxides	3,196	236	--	West Germany 200; United Kingdom 36.
Metal including alloys:				
Unwrought	5,746	2,522	--	France 1,521; Belgium-Luxembourg 393; Bahrain 343.
Semimanufactures	11,841	12,572	5	West Germany 5,135; France 2,652; Turkey 1,162.
Chromium: Oxides and hydroxides	21	4	--	All from West Germany.
Cobalt: Oxides and hydroxides	1	--		
Copper: Metal including alloys:				
Unwrought	57	43	--	Netherlands 30; Kuwait 7.
Semimanufactures	9,391	6,960	(2)	United Kingdom 1,856; Belgium-Luxembourg 1,317; France 1,106.
Iron and steel: Metal:				
Scrap	6,451	1,778	14	Spain 1,704.
Pig iron, cast iron, related materials	4,521	5,801	(2)	Bulgaria 3,497; West Germany 2,300.
Ferroalloys: Ferromanganese	776	332	--	U.S.S.R. 200; France 120.
Steel, primary forms	54,097	126,620	1	U.S.S.R. 26,123; Netherlands 19,055; Bulgaria 17,298.
Semimanufactures:				
Bars, rods, angles, shapes, sections	123,267	395,972	7,922	Spain 98,222; U.S.S.R. 72,130; Romania 57,210.
Universals, plates, sheets	74,525	91,786	21	Hungary 25,359; West Germany 11,312; U.S.S.R. 10,083.
Hoop and strip	28,639	22,285	212	Greece 8,562; Austria 5,666; Italy 1,958.
Rails and accessories	9,293	661	--	U.S.S.R. 413; Italy 126.
Wire	19,594	9,533	131	Romania 3,451; U.S.S.R. 2,296.
Tubes, pipes, fittings	(3)	97,424	4,875	West Germany 25,509; United Kingdom 15,132; Romania 10,084.
Castings and forgings, rough	6,540	11,498	46	Romania 5,004; Italy 1,397; Czechoslovakia 994.
Lead:				
Oxides	375	--		
Metal including alloys:				
Unwrought	2,680	1,204	--	Italy 1,200.
Semimanufactures	211	182	--	France 175.
Manganese: Oxides	--	10	--	All from Belgium-Luxembourg.
Nickel: Metal including alloys:				
Unwrought	15	38	--	Canada 20; West Germany 14.
Semimanufactures	3	41	--	Hungary 40.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
METALS —Continued				
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$13	$5	--	All from West Germany.
Tin: Metal including alloys:				
Unwrought	68	13	--	Belgium-Luxembourg 10; China 3.
Semimanufactures	18	10	--	Denmark 9.
Titanium: Oxides	336	378	--	Turkey 316; United Kingdom 34.
Tungsten: Metal including alloys, all forms	--	20	--	All from Hungary.
Zinc:				
Oxides	779	109	79	Netherlands 16.
Metal including alloys:				
Unwrought	1,717	1,147	--	Bulgaria 976.
Semimanufactures	46	809	--	Belgium-Luxembourg 500; Greece 263.
Other:				
Oxides and hydroxides	417	136	66	Lebanon 40; France 22.
Base metals including alloys, all forms value, thousands	$8	$2	--	All from West Germany.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	315	163	--	Lebanon 130; Italy 33.
Artificial: Corundum	410	--		
Grinding and polishing wheels and stones	61	363	--	Italy 282; Czechoslovakia 30; Japan 16.
Asbestos, crude	4,849	2,468	--	Poland 883; Sweden 390.
Barite and witherite	3,918	3,087	120	Kuwait 1,597; Turkey 1,337.
Boron materials: Oxides and acids	31	5	--	France 2; West Germany 2.
Cement	49,206	18,292	--	Lebanon 10,552; Turkey 3,514.
Chalk	2,658	1,995	--	France 1,070; Belgium-Luxembourg 644.
Clays, crude	7,571	14,195	55	West Germany 8,011; Bulgaria 1,885; United Kingdom 1,611.
Diatomite and other infusorial earth	1	48	--	United Kingdom 35; West Germany 10.
Feldspar, fluorspar, related materials	1,027	4,006	--	Spain 2,092; West Germany 1,635.
Fertilizer materials: Manufactured:				
Ammonia	6	30	--	Netherlands 19; West Germany 11.
Nitrogenous	145,516	2,257	--	Netherlands 1,567; Bulgaria 503.
Phosphatic	13,271	531	--	Bulgaria 314; Belgium-Luxembourg 196.
Potassic	11,673	19,765	--	West Germany 10,501; Italy 9,264.
Unspecified and mixed	32	203	86	West Germany 52; France 20.
Graphite, natural	420	1,688	--	Republic of South Africa 1,453; Italy 235.
Gypsum and plaster	12	3	--	Mainly from Italy.
Lime	962	695	--	Turkey 400; Lebanon 139; Netherlands 116.
Magnesium compounds, unspecified	10	15	--	All from Netherlands.
Mica: Worked including agglomerated splittings	1	7	--	Mainly from France.
Pigments, mineral: Iron oxides and hydroxides, processed	508	199	--	Spain 120; West Germany 54.
Precious and semiprecious stones other than diamond: Natural value, thousands	$20	--		
Salt and brine	11	201	--	Netherlands 115; Belgium-Luxembourg 60.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	17,087	18,508	8	Turkey 17,571; Bulgaria 820.
Sulfate, manufactured	10,954	10,581	9	West Germany 4,088; Italy 3,202; Netherlands 1,325.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	112	4,530	15	Turkey 3,028; Italy 784.
Worked	691	2,414	--	Italy 2,114.
Dolomite, chiefly refractory-grade	--	150	--	All from U.S.S.R.
Gravel and crushed rock	11,973	4,834	1	Italy 3,494; Turkey 1,304.
Quartz and quartzite	483	197	--	Turkey 76; Romania 72; Lebanon 32.
Sand other than metal-bearing	100	90	--	Italy 70; Romania 14.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur:				
Elemental:				
Crude including native and by-product	46,427	17,447	--	Saudi Arabia 16,497.
Colloidal, precipitated, sublimed	220	1,357	--	Greece 1,254; France 78.
Sulfuric acid	386	7	--	Mainly from France.
Talc, steatite, soapstone, pyrophyllite	3,130	442	--	China 415.
Other: Crude	829	521	--	West Germany 237; Spain 146.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	30	--		
Carbon black	3,605	1,212	--	West Germany 959; Netherlands 193.
Coal:				
Briquets of anthracite and bituminous coal	522	250	--	All from Belgium-Luxembourg.
Lignite including briquets	--	50	--	All from United Kingdom.
Coke and semicoke	4,929	3,683	--	Italy 3,474.
Peat including briquets and litter	--	34	--	All from United Kingdom.
Petroleum:				
Crude, thousand 42-gallon barrels	43,750	44,807	--	Iran 34,136; Libya 9,583.
Refinery products:				
Liquefied petroleum gas do	345	1,310	--	Greece 527; Italy 435; Libya 134.
Gasoline, motor do	213	35	--	Italy 34.
Mineral jelly and wax do	4	4	--	West Germany 2; Japan 1.
Kerosene and jet fuel do	994	657	--	Italy 244; Czechoslovakia 162.
Distillate fuel oil do	376	--		
Lubricants do	823	260	21	Italy 190; United Kingdom 30.
Residual fuel oil do	1,324	1,107	--	Romania 893; U.S.S.R. 147.
Bituminous mixtures do	14	2	(2)	Mainly from Romania.

[1]Table prepared by Virginia A. Woodson.
[2]Less than 1/2 unit.
[3]Unreported quantity valued at $84,611,000.

PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN[10]

The Government in Aden continued its efforts at post-Civil War reconstruction by revising its 1986-90 development plan to include a capital spending budget of $1.7 billion, mostly for repairs to factories and infrastructure. The beginning of an indigenous oil industry brought the promise of increased prosperity. The Government's association with the Soviet Union remained strong, and the Soviets were deeply involved in the development of the oil industry.

The Soviet Union agreed in late 1986 to finance oil exploration until 1990 with a $190 million loan, and to conduct geological and geophysical exploration at Shabwa, 300 kilometers northeast of Aden, which included 164,000 feet of hole by 1989. By the beginning of 1987, eight rigs were operating on the 13,500-square-mile Shabwa block adjoining Yemen Hunt Oil Co.'s Marib-Jawf exploration permit in north Yemen. In early 1987, the Government announced that three wells struck oil. By yearend, a reserve was established of about 3.8 billion barrels of low-sulfur oil rated at 36° to 41° API. The estimated recoverable proportion was not revealed. Production capacity was estimated at about 25,000 bbl/d, which was sufficient for local needs, but actual output was lower, with 5,000 to 10,000 bbl/d being trucked to the Aden refinery. Oil for export would eventually be transported to Bir Ali on the Arabian Sea through a pipeline to be built by the Soviet Union for about $473 million. A gas separation and desulfuring units at Shabwa were also envisaged.

Elf Aquitaine Petroleum was awarded a 6-year production sharing concession covering a 19,374-square-kilometer onshore-offshore tract in the Aden-Abayan area in the southwestern region of south Yemen. Exploration would include geological studies, aerial magnetic and seismic surveys, and drilling.

The Braspetro Group, consisting of Petrobras International S.A., Hispánica de

Petróleos S.A., and British Petroleum Corp., drilled four dry holes and intended to relinquish its 33,600-square-kilometer concession in the Hurrin-Ghayda block in the eastern part of the country. The Independent Petroleum Group, a privately owned Kuwaiti organization, was looking for partners to continue seismic surveys and drilling in its concession at Balhaf, east of Aden.

In January 1987, the Government signed a 1-year, renewable agreement to process 20,000 bbl/d of oil for the Kuwait Petroleum Corp. in the Aden refinery. Previously, the volume of Kuwaiti oil processed was 10,000 bbl/d. The Government also discussed with Qatar the possibility of processing 10,000 to 20,000 bbl/d of Qatari oil. The 170,000-bbl/d Aden refinery also processes 12,000 bbl/d of Soviet Union oil.

YEMEN ARAB REPUBLIC[11]

The Yemen Arab Republic (YAR) joined the ranks of oil exporters when its 225,000-bbl/d export pipeline from Alif Oilfield to the Red Sea was inaugurated in December 1987. This meant increased economic independence for the YAR, which had been depending on aid from oil-producing neighbors and remittances from Yemenis working in those countries, both of which amounted to about 40% of the GDP. However, the prospect of becoming an oil exporter increased popular expectations of prosperity and, therefore, adversely affected economic policy. Tight fiscal strategies of 1986 were abandoned, import controls were relaxed (resulting in a larger than expected current account deficit), and foreign borrowing and spending rose substantially. The overall fiscal deficit was estimated at 22% of the GDP. Although the Government's new draft budget forecast oil revenues of $600 to $700 million on the basis of an output of 200,000 bbl/d and a price of $15 per barrel, the Government anticipated that this new income would merely offset the recent decline in remittances and foreign aid.

Oil production at yearend was 150,000 bbl/d and was scheduled to rise to 175,000 bbl/d when the Azal Oilfield was brought on-stream in early 1988. Production was expected to rise to 200,000 bbl/d when the recently damaged offshore tanker storage facility, having a capacity of 3 million barrels, was operational. Several additional small fields were discovered, including Lam, Meem, and Noon. A national marketing agency was formed, but initial sales were to be handled by Exxon Corp. The Government was to market 70,000 bbl/d of the initial export volume, with the remainder going to Hunt Oil Co., Exxon Corp., and Yukong Ltd. of the Republic of Korea. Mobil Oil Corp., Azienda Generali Italiana Petroli S.p.A. (AGIP) of Italy, and Yukong agreed to take 1.3 million barrels each during 3-month periods for the Government's share. Other sales contracts were signed with Texaco Inc., Mitsui Oil Co., and Nippon Oil Co.

Yemen Hunt Oil drilled 131 wells, of which all but 20 showed hydrocarbons. The country's oil reserves were officially put at 500 million barrels, but they may be as much as 1 billion barrels with newer discoveries. Gas reserves discovered in the Alif Field totaled more than 4 Tcf. The pipeline can be expanded to handle 400,000 bbl/d, and the Government commissioned studies to determine the feasibility of an oil refinery with a capacity of 50,000 bbl/d and the feasibility of using the gas for factories and power generating stations. An LPG bottling plant was also being considered for construction.

The YAR's Ministry of Oil and Mineral Resources announced that it required a review of existing mineral survey work, a new detailed general survey of mineral resources, and a minerals development plan. Commodities that may be available in commercial quantities were copper, gold, gypsum, lead, marble, silver, uranium, and zinc. In addition, U.S. companies would be allowed exclusive rights to develop mineral resources. The U.S.S.R. agreed to assist in producing a geological map of the YAR. The Government also contacted several U.S. mineral and mining companies in connection with this announced plan.

A contract was to be awarded to one of three Japanese-led consortia for a feasibility study for the Yemen Fertilizer Co. The proposed new plant would be based on local natural gas from the Marib basin. The product, probably urea, would be used locally and possibly exported.

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[1]Physical scientist, Division of International Minerals.
[2]Senior foreign minerals specialist, Division of International Minerals.
[3]Prepared by Charles L. Kimbell.
[4]Prepared by Michael D. Fenton.
[5]Prepared by Michael D. Fenton.
[6]U.S. Embassy (Lebanon). State Dep. Airgram, 86 State A-417, June 2, 1988.
[7]Prepared by Michael D. Fenton.
[8]Prepared by Michael D. Fenton.
[9]Prepared by Michael D. Fenton.
[10]Prepared by Michael D. Fenton.
[11]Prepared by Michael D. Fenton.

The Mineral Industry of Other Areas of South America

By Harold R. Newman, Ivette E. Torres, and Pablo Velasco

CONTENTS

ECUADOR[1]

The performance of Ecuador's mineral industry continued to be affected not only by depressed oil prices in recent years but also by natural disasters. In March 1987, Ecuador canceled foreign debt payments for the rest of the year and appealed for international aid because of a series of earthquakes that destroyed villages and crippled the nation's oil industry. The earthquake destroyed a key section of the country's main oil pipeline and forced a halt to production and shipment of Ecuador's most important export product. Ecuador produces 240,000 barrels of oil per day and exports 144,000 barrels daily. Oil accounts for 60% of the nation's hard currency earnings.

The Government of Ecuador asked the Organization of Petroleum Exporting Countries and other oil-producing countries to assume Ecuador's oil sales commitments. Ecuador agreed to pay the countries back in an equivalent amount of oil when it was able to resume exports.

Over the past 2 years there has been increased interest in Ecuador's mining industry, which continued to be a marginal contributor to the national economy. Both foreign and domestic capital have been invested in small-scale mining activities and exploration for precious metals throughout the country. These activities have been stimulated by both the country's mineral potential and by the new and favorable mining law implemented in August 1985.

Preliminary Government statistics indicate that Ecuador's real gross domestic product (GDP) declined 3% to $9.4 billion[2] in 1987 dollars, reversing the 2.9% growth rate registered in 1986. This reversal was attributed entirely to the 35% decline in the output of the petroleum sector. The consumer price index increased 33% during 1987 compared with a 27% increase the previous year. Ecuador's balance of payments continued to deteriorate in 1987 owing to the dramatic decline in oil exports. Oil exports in 1987 were valued at $779 million, a reduction of $204 million from the low 1986 level. Crude oil production in 1987 totaled 63.7 million barrels, a 39% decline. The decline in oil production and exports was due to the earthquake destruction of more than 30 kilometers of the Trans-Ecuadorean oil pipeline, forcing significantly reduced oil production for more than 5 months. After

completion of repairs to the pipeline, production was reestablished to about 320,000 barrels per day.

The dominant petroleum producer, with more than 80% of the total output, continued to be La Corporación Estatál Petrolera Ecuatoriana (CEPE), the state oil corporation. It was followed by CEPE-Texaco, an operation jointly owned by CEPE (62.5%) and Texaco Inc. (37.5%) and CEPE-City Investing Co. In 1987, the Government cleared the way for major international oil companies to begin exploring large areas of the country. These activities were carried out offshore, in the eastern jungle region, and in the central western plains. The following foreign companies conducted exploration in Ecuador: Occidental Petroleum Corp., British Petroleum C.A., Esso-Hispanoil, Texaco-Pecten, Belco Petroleum Corp., Conoco Petroleum Corp., Tenneco Oil Exploration and Production Co., Petróleo Brasileiro S.A. (PETROBRÁS), Société Nationale Elf Aquitaine of France, and Petro-Canada International Assistance Corp. Initial exploration included seismic surveys and exploratory drilling. The fifth round of bidding for petroleum exploration contracts was concluded in November. Bids were received for three of the six blocks offered.

By yearend, there were 34 foreign companies committed to invest $400 million in exploration of 3.5 million hectares. On May 25, the Government of Ecuador and a consortium led by Tenneco signed a risk exploration-exploitation contract under which the consortium will search for oil in Ecuador's southern Amazon jungle. The contract calls for the consortium to drill four wells over the next 4 years in Block 12, a 200,000-hectare area due south of the CEPE-Texaco area.

Belco, a subsidiary of Enron Exploration Co. of Houston, Texas, is the sole contractor for exploration of Blocks 1 and 2 on the Pacific coast near Guayaquil. Block 2 is entirely offshore, while Block 1 includes a small onshore section just north of small but still productive oilfields in the Santa Elena Peninsula. Under Belco's contract, which was to expire in July 1989, the company had completed 6,000 kilometers of seismic exploration offshore and drilled two dry holes, after an initial investment of about $18 million. Belco operated two drilling platforms constructed in Guayaquil, which were completed in 1987. Elf Aquitaine was the operating partner for exploration in Block 14 with PETROBRÁS and Yacimientos Petrolíferos Fiscales (YPF) of Argentina. The contract was won in the third round of contracts that were open only to state-owned firms, and it was signed in May 1987. Block 14 is in the eastern jungle, just east of Texaco's important Auca oilfield and wedged between the Oxy Block to the north and the Conoco Block to the south.

The official institution created by the new mining legislation, Instituto Ecuatoriano de Minería (INEMIN), is in charge of regulating mining activities throughout the country. INEMIN has initiated exploratory and development programs as part of a national mining plan. These programs are mostly in the southern part of the country where the potential for finding precious metals is higher. At the same time, attention was given to development of deposits of industrial minerals.

A mining project for precious metals, mainly silver, was being carried out by Armeno Resources Inc., a Canadian company based in Vancouver, British Columbia, Canada, at the San Bartolomé Mine in Azuay Province, 30 kilometers southeast of Cuenca, the third largest city in Ecuador. This mine presently has 90,000 tons of proven and probable ore reserves grading 712 grams of silver per ton, 0.7% lead, and 2.2% zinc. Further exploration work by the company has delineated additional ore reserves in the amount of 585,000 tons of ore with similar grades. The company was planning to initiate a pilot production plant by mid-1988, together with the installation of a 100-ton-per-day processing plant. Armeno Resources also acquired three other properties in the same mining district—El Eriván, Peggy I, and Peggy II deposits. The three concessions, comprising 3,900 hectares, are close to the city of Cuenca, with easy access by road and with electric power facilities close by.

A joint gold dredging venture at Los Lilenes concession near Machala, 140 kilometers from Guayaquil, was initiated by Osborne and Chapel Gold Fields Ltd. of Canada and Los Lilenes S.A., a company with Panamanian and Ecuadorean interests. The deposits to be exploited, Ecuaba A and B and Los Lilenes I and II, cover 28,500 hectares. The Los Lilenes gold dredging project was the object of an agreement with the International Finance Corp. (IFC), which will participate in the development by supplying up to $17.4 million. The project would be the largest gold mining operation undertaken to date by Osborne and Chapel Gold Fields Ltd. The mineral concession was estimated to have potential re-

serves of 2.3 million troy ounces of gold. Total capital cost was estimated at $55 million, with development of the known placer gold deposits taking place over 3 years. Under the agreement with IFC, a new Ecuadorean company will be formed in which Osborne & Chapel and its partners in Ecuador would each have 40% interest and IFC 20%.

Avino Mines & Resources Ltd. of Canada acquired an option to purchase a 70% interest in the Guaysimi gold concession in southern Ecuador. It subsequently sold 20% of the interest to defray exploration costs. The Guaysimi concession, 24 acres in size, is located 3 miles east of Nambija, Ecuador's most important gold region. Preliminary rock and trench sampling on the Guaysimi gold deposit indicates the presence of up to 4 grams of gold per ton. Avino Mines was attracted by incentives offered by INEMIN to mining investors, such as the elimination of taxes and duties on imported equipment and machinery, low taxes, and low surface fees. Exploration of the Guaysimi property began early in 1987.

Condor Minerals and Energy Ltd. of Australia secured an option to acquire up to 50% of an alluvial gold resource in the Guayaquil region. The 4,400-hectare concession contains potential reserves of 900,000 cubic meters of alluvial material grading 0.52 grams of gold per cubic meter. The company said there was the potential for much larger gold reserves. Condor planned to construct a facility to produce an estimated 10,000 ounces of gold per year to provide an early cash flow. Expansion would increase output to 40,000 ounces of gold per year.

Great Eastern Mines Ltd. of Australia acquired an interest in a number of gold concessions in Ecuador through a 50%-owned joint-venture exploration company. The major properties include the León-Balau alluvial gold deposits, in which Great Eastern holds a 35% stake. The partners will invest $1 million in further exploration of the property, which covers more than 14,000 hectares. Initial activity included the installation of a 15-cubic-meter-per-hour pilot plant that was already under way at the León concession. The company plans to install two 100-cubic-meter-per-day processing plants to work the shallower gravels of the León area. These could produce an estimated 10,000 ounces of alluvial gold per year.

Overseas Platinum Ltd. and Wright Engineers of Canada acquired the Las Playas gold-platinum placer prospect in Ecuador. The property was purchased for 100,000 shares and a commitment to spend $100,000 in 1988. The previous owner retained a 5% net profit interest. Elsewhere in Ecuador, the Buenavista and Pindilig concessions, both in south-central Ecuador, granted by INEMIN to Pacific Rim Platinum S.A., the Ecuadorean subsidiary of Overseas Platinum. A jointly owned Government-and-cooperative gold mining company, Cía. Minera Nambija, was reviewing offers from nine companies to operate a plant that would raise the output to 10 kilograms of gold per day from 2 kilograms of gold per day over the next year. The bulk of the gold extracted from the mine so far was done manually, and the proposed new plant would automate the process to increase gold production.

The total amount of Ecuador's gold production was not precisely known due to lack of statistics from Government sources; however, it was estimated that the total production of gold in 1987 was in the range of 290,000 to 325,000 ounces. Most of the gold produced in Ecuador came from small mining cooperatives. The major center for these activities was the Nambija region, where gold was discovered in the early 1980's in what is considered to be a skarn deposit. These activities, in which hundreds of holes have been dug into the mountainside, were of economic value to the miners only when the material excavated graded more than 100 grams of gold per ton. Gold was mainly recovered by amalgamation. Mining under similar conditions, either with permits issued by INEMIN or as clandestine operations, also increased in the Portovelo-Zaruma mining district and in the newly active Ponce Enriquez locality. Rudimentary mining and processing methods were employed, and although both amalgamation and cyanidation methods of gold recovery have been introduced, it was estimated that 80% of the gold was not recovered.

The Ecuadorean mining sector at yearend was troubled by invasions of concessions and disputed claims, but the most recent invasion, according to Government officials, was a particularly clear-cut case. The Norwegian company CUMBINAMESA had a prospecting claim at a site called Augusta in the Zamora-Chinchipe district. The company made a find, whereupon four employees decided to go into business for themselves with the help of a Zamora lawyer. They recruited about 150 men, ran off the 30 CUMBINAMESA employees and then

set up a mining camp to work the claim. Despite of repeated requests by the company and the Chamber of Mining, no action by yearend had been taken by Government authorities to dislodge the claim jumpers. The Provincial Governor did not respond to the company's request for police assistance. INEMIN, which had regulatory authority but no enforcement powers, indicated that it was not prepared to take any politically sensitive action during the remaining months of the Administration. The considerable international mining investments could be jeopardized if enforcement of the mining laws were a problem. This would also have a negative impact upon Ecuador's efforts to attract foreign investments in this sector of the economy.

Table 1.—Other Areas of South America: Production of mineral commodities[1]

Country and commodity	1983	1984	1985	1986[p]	1987[e]
ECUADOR[2]					
Cadmium, mine output, Cd content[e] kilograms	350	300	300	300	300
Cement, hydraulic thousand metric tons	1,420	[r]1,874	1,742	3,866	[3]1,601
Clays:					
Common clay metric tons	60,000	92,750	233,749	26,472	[3]29,200
Kaolin do.	1,000	[r]2,484	2,981	2,000	2,000
Copper, mine output, Cu content do.	[r]193	180	100	100	100
Feldspar do.	--	2,084	3,389	2,298	[3]1,558
Gas, natural:					
Gross million cubic feet	17,008	18,111	21,495	[e]22,000	NA
Marketable do.	2,568	4,769	4,583	[e]2,600	NA
Gold, mine output, Au content troy ounces	[r]67,900	280,000	300,000	317,327	[3]305,432
Gypsum (for cement) metric tons	[r]300,000	[r]213,941	316,468	290,680	[3]255,289
Iron and steel:					
Steel, crude do.	22,768	18,143	17,874	17,084	[3]25,200
Semimanufactures do.	150,755	138,611	133,182	181,850	[3]172,400
Lead concentrate, Pb content do.	225	200	200	200	200
Natural gas liquids:					
Natural gasoline thousand 42-gallon barrels	108	178	229	NA	NA
Liquefied petroleum gas do.	643	1,077	591	NA	NA
Total do.	751	1,255	820	NA	NA
Petroleum:					
Crude do.	86,341	94,915	102,415	[e]105,000	63,700
Refinery products:					
Gasoline do.	6,109	7,850	7,630	NA	NA
Jet fuel do.	907	1,045	1,124	NA	NA
Kerosene do.	2,059	2,279	2,127	NA	NA
Distillate fuel oil do.	5,792	10,077	13,646	NA	NA
Residual fuel oil do.	11,067	9,295	4,111	NA	NA
Lubricants do.	228	283	291	NA	NA
Liquefied petroleum gas do.	382	580	703	NA	NA
Unspecified do.	430	575	718	NA	NA
Refinery fuel and losses do.	548	514	1,089	NA	NA
Total do.	27,522	32,498	31,439	NA	NA
Silica metric tons	7,000	21,437	22,441	36,649	[3]14,675
Silver, mine output, Ag content troy ounces	[3]3,138	2,400	2,000	2,000	2,000
Stone, sand and gravel:					
Limestone (for cement manufacture) thousand metric tons	1,500	[r]3,135	3,762	6,500	[3]2,773
Marble metric tons	6,200	6,679	11,435	15,195	[3]15,210
Sulfur:[e]					
Native do.	5,000	5,000	4,000	4,000	4,500
Byproduct:					
From petroleum do.	5,000	5,000	5,000	5,000	5,000
From natural gas do.	5,000	5,000	5,000	5,000	5,000
Total do.	15,000	15,000	14,000	14,000	14,500
Zinc, mine output, Zn content do.	15	100	100	[e]100	100
FRENCH GUIANA					
Gold, mine output, Au content[e] troy ounces	8,038	10,127	8,005	10,481	11,000
Stone, sand and gravel[e] metric tons	400,000	400,000	400,000	400,000	400,000
GUYANA[2]					
Aluminum:					
Bauxite, dry equivalent, gross weight thousand metric tons	1,087	1,333	1,675	1,466	[3]2,200

See footnotes at end of table.

Table 1.—Other Areas of South America: Production of mineral commodities[1] —Continued

Country and commodity	1983	1984	1985	1986[p]	1987[e]
GUYANA[2] —Continued					
Diamond:[e]					
Gem thousand carats	5	6	4	3	2
Industrial stones do	5	8	7	6	5
Total do	[3]10	14	11	[3]9	7
Gold, mine output, Au content troy ounces	4,607	11,131	10,323	14,035	[3]21,425
PARAGUAY					
Cement, hydraulic thousand metric tons	153	109	46	179	[3]261
Clays:					
Kaolin metric tons	45,000	50,000	60,000	60,000	[3]72,000
Other thousand metric tons	1,600	1,700	1,750	1,650	[3]1,898
Gypsum metric tons	4,000	6,000	2,500	2,800	[3]3,100
Iron and steel:					
Pig iron do	--	--	--	--	31,000
Steel, crude do	--	--	--	--	9,700
Lime do	73,891	85,000	80,270	88,290	[3]92,500
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	434	327	506	382	NA
Jet fuel do	88	18	115	162	NA
Kerosene do	291	88	58	21	NA
Distillate fuel oil do	705	512	623	640	NA
Residual fuel oil do	202	149	223	254	NA
Liquefied petroleum gas do	81	35	47	40	NA
Refinery fuel and losses do	339	167	229	22	NA
Total do	2,050	1,296	1,801	1,521	NA
Pigments, mineral: Natural, ocher metric tons	180	250	260	250	[3]285
Sand including glass sand thousand metric tons	1,602	1,654	1,741	1,659	[3]1,893
Stone:					
Dimension do	71	62	65	65	[3]60
Crushed and broken:					
Limestone (for cement and lime) do	350	175	180	387	[3]507
Other do	1,500	1,730	1,850	1,720	[3]1,990
Marble metric tons	250	300	400	450	[3]600
Talc, soapstone, pyrophyllite do	120	150	120	130	[3]180
SURINAME					
Aluminum:					
Bauxite, gross weight thousand metric tons	3,400	3,454	3,000	3,847	1,200
Alumina do	1,129	1,208	1,000	1,471	[3]370
Metal, primary[4] do	34	23	29	29	9
Cement, hydraulic do	74	50	50	50	50
Clays: Common metric tons	100,000	100,000	100,000	110,000	110,000
Gold, mine output, Au content troy ounces	482	322	500	600	700
Sand and gravel:[e]					
Sand, common thousand metric tons	150	150	NA	160	160
Gravel do	20	20	NA	25	25
Stone, crushed and broken do	50	46	NA	50	50
URUGUAY					
Aluminum, secondary metric tons	24	31	20	51	[3]56
Barite do	3	10	15	15	15
Cement, hydraulic thousand metric tons	401	334	314	340	[3]401
Clays, unspecified metric tons	152,155	70,936	150,000	[e]150,000	150,000
Coke, gashouse[e] do	10,000	10,000	8,000	8,000	8,000
Corundum[e] do	50	50	40	40	40
Feldspar do	1,129	1,950	[e]1,000	[e]1,000	1,000
Gem stones, semiprecious:					
Agate do	53	108	90	[e]90	90
Amethyst do	24	21	20	[e]20	20
Gypsum do	151,832	74,091	[e]100,000	[e]100,000	100,000
Iron and steel:					
Ferroalloys: Electric-furnace ferrosilicon crust do	250	162	250	[e]250	250
Steel, crude do	45,674	40,763	38,964	30,987	30,200
Semimanufactures do	33,602	[r]35,789	31,773	34,348	43,500
Lime thousand metric tons	10	8	9	10	[3]13
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	1,570	1,643	1,649	1,660	NA
Jet fuel do	191	152	184	182	NA
Kerosene do	642	572	452	415	NA
Distillate fuel oil do	3,181	3,348	2,992	2,324	NA

See footnotes at end of table.

Table 1.—Other Areas of South America: Production of mineral commodities[1] —Continued

Country and commodity	1983	1984	1985	1986[p]	1987[e]
URUGUAY —Continued					
Petroleum refinery products —Continued					
Residual fuel oil thousand 42-gallon barrels	2,975	2,725	2,301	2,434	NA
Lubricants do	41	46	--	--	NA
Liquefied petroleum gas do	415	482	498	459	NA
Unspecified do	206	251	189	225	NA
Refinery fuel and losses do	-288	-151	-386	22	NA
Total do	8,933	9,068	7,879	7,721	NA
Sand and gravel:					
Sand, common thousand metric tons	1,598	1,391	1,500	[e]1,500	1,500
Gravel do	439	237	500	[e]500	500
Stone:					
Dimension do	9	10	8	[e]8	10
Crushed and broken:					
Alum schist metric tons	3,234	9,977	8,000	[e]8,000	8,000
Dolomite thousand metric tons	3	4	3	[e]3	3
Limestone do	757	666	700	[e]700	700
Marble do	4	4	4	[e]4	5
Marl metric tons	7,269	4,257	7,000	[e]7,000	7,000
Quartz do	481	150	300	[e]300	300
Other including ballast thousand metric tons	1,908	1,969	1,900	[e]1,900	2,000
Sulfur, elemental, byproduct[e] metric tons	2,000	2,000	2,000	2,000	2,000
Talc, soapstone, pyrophyllite do	685	1,658	1,500	[e]1,500	1,500
Tuff: Tufa do	2,444	4,347	3,500	[e]3,500	3,500

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Includes data available through mid-June 1988.
[2]In addition to the commodities listed, a variety of crude construction materials (common clays, sand and gravel, and stone) undoubtedly are also produced, but output is not reported, and available information inadequate to make reliable estimates of output levels.
[3]Reported figure.
[4]Data represent exports.

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

Commodity	1983	1984	Destinations, 1984	
			United States	Other (principal)
Abrasives, n.e.s.: Natural: Corundum, emery, pumice, etc	561	--		
Aluminum: Metal including alloys, semimanufactures	257	60	--	Chile 32; Colombia 17; Peru 11.
Iron and steel: Metal: Semimanufactures: Bars, rods, angles, shapes, sections	72	--		
Petroleum:				
Crude thousand 42-gallon barrels	58,363	64,209	37,442	Panama 6,693; Chile 395.
Refinery products:				
Kerosene and jet fuel do	--	234	NA	NA.
Distillate fuel oil do	--	61	NA	NA.
Residual fuel oil do	3,702	6,468	NA	NA.
Precious and semiprecious stones other than diamond: Natural value, thousands	--	$5	$5	
Salt and brine	2,000	--		
Sodium compounds, n.e.s.: Sulfate, manufactured	--	4,363	--	Colombia 3,083; Venezuela 868; Peru 412.
Zinc: Metal including alloys, scrap	--	10	--	All to Costa Rica.
Other metals:				
Ores and concentrates	20	--		
Ashes and residues	212	79	--	All to Japan.

NA Not available.
[1]Table prepared by H. D. Willis.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate value, thousands	$2	$460	$156	Netherlands Antilles $304.
Oxides and hydroxides	3,897	4,248	1,978	Guyana 2,000; West Germany 246.
Metal including alloys:				
Unwrought	3,334	4,406	321	Brazil 3,210; Canada 288.
Semimanufactures	2,898	3,289	518	Brazil 809; Venezuela 500.
Chromium:				
Ore and concentrate	--	20	20	
Oxides and hydroxides	21	49	23	West Germany 17; Italy 7.
Cobalt: Oxides and hydroxides	1	1	1	
Copper:				
Ore and concentrate	--	6	6	
Metal including alloys:				
Unwrought	226	10	1	Brazil 5; Canada 4.
Semimanufactures	2,539	4,252	199	Chile 1,731; Peru 1,495; Republic of South Africa 219.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite value, thousands	$10	$1	$1	
Metal:				
Pig iron, cast iron, related materials	56	50	50	
Ferroalloys:				
Ferromanganese	372	231	200	West Germany 25; Spain 6.
Unspecified	85	131	--	Chile 82; Republic of South Africa 36; Spain 7.
Steel, primary forms	148,045	260,335	2	Brazil 178,093; Chile 49,604; Netherlands 10,301.
Semimanufactures:				
Bars, rods, angles, shapes, sections	28,885	89,286	795	Brazil 63,768; Republic of South Africa 5,548; Chile 5,006
Universals, plates, sheets	70,885	108,720	2,530	Brazil 41,518; Japan 41,087; Chile 11,468.
Hoop and strip	2,956	3,858	121	Japan 2,328; West Germany 750; Belgium-Luxembourg 305.
Rails and accessories	6	60	--	All from Italy.
Wire	2,136	1,349	136	Japan 528; United Kingdom 246; Brazil 167.
Tubes, pipes, fittings	12,832	9,559	3,477	France 3,128; Argentina 995.
Castings and forgings, rough	607	501	(2)	Belgium-Luxembourg 500; West Germany 1.
Lead:				
Oxides	1,191	1,478	--	Mexico 1,165; Peru 245; Italy 48.
Metal including alloys:				
Unwrought	1,239	1,387	63	Peru 687; Mexico 569; Canada 65.
Semimanufactures	18	3	2	West Germany 1.
Magnesium: Metal including alloys, semimanufactures	17	1	1	
Manganese: Oxides	1,090	799	76	Colombia 673; Brazil 41.
Mercury 76-pound flasks	29	551	551	
Molybdenum: Metal including alloys, all forms value, thousands	$32	$7	--	All from United Kingdom.
Nickel: Metal including alloys, semimanufactures	40	40	4	West Germany 17; Canada 14.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, platinum value, thousands	$633	--		
Silver:				
Ore and concentrate do	$292	--		
Metal including alloys, unwrought and partly wrought do	$204	$22	$3	Spain $15; West Germany $4.
Tin: Metal including alloys:				
Scrap	--	5	5	
Unwrought	1	13	3	Belgium-Luxembourg 6; Peru 2.
Semimanufactures	11	18	(2)	Bolivia 6; West Germany 6; Japan 3.
Titanium: Oxides	1,583	999	26	West Germany 411; United Kingdom 221; Mexico 190.
Tungsten: Metal including alloys, all forms value, thousands	--	$101	--	Brazil $92; West Germany $9.
Zinc:				
Ore and concentrate	--	7	7	
Oxides	365	213	69	Colombia 50; Peru 43.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
METALS —Continued				
Zinc —Continued				
Metal including alloys:				
Scrap	2	--	--	
Unwrought	4,028	4,324	--	Peru 2,460; Canada 1,764; Greenland 100.
Semimanufactures	35	8	(2)	Brazil 4; Peru 4.
Other:				
Ores and concentrates	230	210	160	Republic of South Africa 50.
Oxides and hydroxides	167	160	84	West Germany 18; France 2.
Base metals including alloys, all forms	1	5	4	Brazil 1.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	23	36	2	Italy 16; West Germany 6; Canada 3.
Artificial:				
Corundum	13	28	(2)	Brazil 24; West Germany 4.
Silicon carbide	25	89	--	Argentina 50; Brazil 29; Italy 4.
Grinding and polishing wheels and stones	224	416	58	Brazil 114; Italy 77; Belgium-Luxembourg 67.
Asbestos, crude	6,030	5,177	128	Canada 4,382; Republic of South Africa 629.
Barite and witherite	3,417	34	7	Peru 20; Italy 6.
Boron materials:				
Crude natural borates	5	1	1	
Oxides and acids	274	335	56	Peru 243; Italy 27.
Cement	25,651	41,561	4	Mexico 30,000; Peru 4,150; Colombia 3,528.
Chalk	640	1,113	--	Belgium-Luxembourg 560; Peru 475; France 50.
Clays, crude	6,324	3,498	3,237	United Kingdom 155; Peru 60.
Diamond:				
Gem, not set or strung value, thousands	$6	--	--	
Industrial stones do	$329	$272	--	Belgium-Luxembourg $245; Switzerland $27.
Diatomite and other infusorial earth	700	416	184	Mexico 220; Peru 10.
Feldspar, fluorspar, related materials	223	591	--	Peru 325; Italy 138; Colombia 100.
Fertilizer materials:				
Crude, n.e.s	1	5	5	
Manufactured:				
Ammonia	32	160	14	Colombia 94; West Germany 52.
Nitrogenous	54,382	89,365	17,420	Yugoslavia 39,000; Hungary 21,500.
Phosphatic	211	9,060	8,610	West Germany 300; Netherlands 120.
Potassic	16,845	31,185	17,163	West Germany 14,002; Israel 20.
Unspecified and mixed	25,452	33,845	30,258	West Germany 2,860; Norway 500.
Graphite, natural	8	11	3	Brazil 6; West Germany 2.
Gypsum and plaster	10,283	104,736	610	Spain 85,028; Peru 9,000; Jamaica 5,000.
Lime	140	--	--	
Magnesium compounds: Magnesite, crude	4	4	--	All from West Germany.
Mica:				
Crude including splittings and waste	24	29	9	Peru 20.
Worked including agglomerated splittings value, thousands	$5	$1	--	All from West Germany.
Phosphates, crude	(2)	162	--	Peru 160; West Germany 1; Netherlands 1.
Pigments, mineral: Iron oxides and hydroxides, processed	215	290	35	West Germany 102; Brazil 49.
Precious and semiprecious stones other than diamond: Synthetic value, thousands	$28	$4	--	NA.
Salt and brine	439	7,227	(2)	Peru 7,160; United Kingdom 66; West Germany 1.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	7,356	9,467	5,002	West Germany 2,415; Poland 1,820.
Sulfate, manufactured	9,276	3,652	93	Mexico 2,030; Peru 565; Colombia 421.
Stone, sand and gravel:				
Dolomite, chiefly refractory-grade	412	623	--	Peru 465; Spain 129; Norway 22.
Quartz and quartzite	--	7	7	
Sand other than metal-bearing value, thousands	$36	$17	$6	Italy $9; West Germany $2.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1983	1984	Sources, 1984	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur:				
Elemental:				
Crude including native and by-product	1,233	3,506	--	Colombia 3,490; West Germany 11; Belgium-Luxembourg 5.
Colloidal, precipitated, sublimed	150	146	104	West Germany 25; Colombia 15.
Sulfuric acid	4,250	7,361	6,200	Peru 1,000; Netherlands 87.
Talc, steatite, soapstone, pyrophyllite	611	863	304	Italy 73; Austria 71.
Other:				
Crude	542	504	243	Spain 141; Italy 98.
Slag and dross, not metal-bearing	12	105	105	
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	97	112	30	Colombia 82.
Carbon black	3,390	2,902	25	Colombia 2,448; Venezuela 290; West Germany 121.
Coal:				
Anthracite and bituminous	648	32	--	Belgium-Luxembourg 23; West Germany 9.
Lignite including briquets	37	--		
Coke and semicoke	702	250	--	All from Colombia.
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	23	81	81	
Gasoline, motor do.	255	476	476	
Mineral jelly and wax do.	31,102	52,816	3,974	Japan 19,950; West Germany 19,817; Brazil 4,706.
Lubricants do.	272,090	286,132	11,067	Netherlands Antilles 270,480; West Germany 1,099.
Bitumen and other residues do.	630	1,036	1,036	
Bituminous mixtures do.	206	200	188	Denmark 12.

NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.

FRENCH GUIANA[3]

French Guiana's mining industry continued to be a small sector of the economy in 1987. The industry produced small amounts of columbite and tantalite, gold, sand and gravel, and stone.

Table 4.—French Guiana: Exports and reexports of mineral commodities[1]

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
Abrasives, n.e.s.: Natural: Corundum, emery, pumice, etc. value, thousands	$8	--		
Copper: Metal including alloys, scrap	26	--		
Iron and steel: Metal:				
Scrap	86	31	--	All to Brazil.
Semimanufactures:				
Universals, plates, sheets	--	3	--	All to France.
Tubes, pipes, fittings	1	--		
Petroleum refinery products:				
Gasoline 42-gallon barrels	--	4,692	--	All to Guadeloupe.
Distillate fuel oil do.	--	6,901	--	Do.
Residual fuel oil do.	--	5,501	--	Do.
Tantalum: Metal including alloys, all forms	1	--		

[1]Table prepared by H. D. Willis. French Guiana did not report any exports or reexports of mineral commodities to the United States in 1986.

Table 5.—French Guiana: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	--	1		All from France.
Metal including alloys:				
Unwrought value, thousands	$1	--		
Semimanufactures	98	52	--	France 49; West Germany 1.
Copper: Metal including alloys, semimanufactures	49	57	--	France 54; Austria 1.
Iron and steel: Metal:				
Scrap value, thousands	--	$1	--	All from France.
Ferroalloys	(2)	3	--	Do.
Semimanufactures:				
Bars, rods, angles, shapes, sections	2,195	3,747	--	France 1,830; Belgium-Luxembourg 1,484; West Germany 433.
Universals, plates, sheets	2,986	2,498	--	France 2,310; Belgium-Luxembourg 159; Martinique 26.
Hoop and strip	8	2	--	All from France.
Rails and accessories	42	4	--	Do.
Wire	36	26	--	Do.
Tubes, pipes, fittings	1,047	955	1	France 823; Spain 71; Belgium-Luxembourg 25.
Castings and forgings, rough	41	38	--	All from France.
Lead:				
Oxides value, thousands	$2	$1	--	Do.
Metal including alloys, semimanufactures	--	2	--	Do.
Mercury value, thousands	$8	$6	--	Do.
Tin: Metal including alloys, semimanufactures do	--	$2	--	Do.
Titanium: Oxides	--	2	--	Do.
Zinc: Metal including alloys, semimanufactures	--	1	--	Do.
Other:				
Ashes and residues	39	41	--	Do.
Base metals including alloys, all forms value, thousands	$1	$4	--	Do.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	23	31	--	Do.
Grinding and polishing wheels and stones	9	9	--	France 5; Italy 3; Netherlands 1.
Boron materials: Oxides and acids	--	1	--	All from France.
Cement	39,771	42,816	--	Martinique 19,320; France 11,018; Guadeloupe 6,035.
Chalk	--	11	--	All from France.
Clays, crude	7	7	(2)	Brazil 5; France 2.
Diamond: Gem, not set or strung value, thousands	$3	$13	--	France $8; Belgium-Luxembourg $5.
Fertilizer materials:				
Crude, n.e.s	1	1	--	All from France.
Manufactured:				
Ammonia	8	4	--	Do.
Nitrogenous	375	749	--	France 677; Netherlands 54; Belgium-Luxembourg 18.
Phosphatic	20	144	--	Belgium-Luxembourg 120; France 24.
Potassic	31	102	--	Belgium-Luxembourg 80; France 22.
Unspecified and mixed	2,019	1,160	--	France 1,052; Tunisia 60; Martinique 40.
Gypsum and plaster	--	50	--	All from France.
Lime	300	557	--	Martinique 380; France 177.
Mica: Worked including agglomerated splittings	--	7	--	All from France.
Precious and semiprecious stones other than diamond: Natural value, thousands	$53	$85	--	Brazil $51; France $24; Belgium-Luxembourg $5.
Salt and brine	504	376	--	West Germany 167; France 163; Netherlands 24.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	1	1	--	All from France.
Sulfate, manufactured	245	107	--	Do.

See footnotes at end of table.

Table 5.—French Guiana: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	20	260	--	France 257; Brazil 3.
Worked	75	34	--	Brazil 24; France 9; Spain 1.
Dolomite, chiefly refractory-grade	60	58	--	All from France.
Gravel and crushed rock	6	13	--	Do.
Quartz and quartzite				
value, thousands	--	$2	--	Do.
Sand other than metal-bearing	80	195	--	Do.
Sulfur:				
Elemental, crude including native and byproduct	--	1	--	Mainly from Martinique.
Sulfuric acid	19	5	--	Mainly from France.
Other: Crude	88	69	--	All from France.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	25	--		
Coal excluding briquets	--	23	--	Do.
Coke and semicoke	1	--		
Peat including briquets and litter	--	20	--	Belgium-Luxembourg 14; France 3; Netherlands 3.
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	24,453	21,425	--	Trinidad and Tobago 21,205; France 220.
Gasoline ---do---	187,757	147,586	--	Trinidad and Tobago 147,195; France 382.
Mineral jelly and wax ---do---	8	8	--	All from France.
Kerosene and jet fuel ---do---	99,921	90,001	--	Trinidad and Tobago 89,985; France 16.
Distillate fuel oil ---do---	358,647	300,548	--	Trinidad and Tobago 278,333; Venezuela 14,599; Mexico 7,609.
Lubricants ---do---	6,790	8,477	14	France 7,140; Jamaica 560; Belgium-Luxembourg 476.
Residual fuel oil ---do---	143,983	124,509	--	All from Trinidad and Tobago.
Bitumen and other residues ---do---	5,963	14,502	--	Trinidad and Tobago 11,344; Netherlands Antilles 2,933; France 224.
Bituminous mixtures ---do---	97	18	--	All from France.

[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.

GUYANA[4]

In 1987, Guyana had an estimated growth of 3% in GDP. This was a marked improvement over the 1986 growth in GDP of less than 1%. A shortage of foreign exchange continued to hamper recovery of Guyana's mineral industry. The country continued to seek external financial assistance to bolster the industry, particularly in the areas of bauxite and gold development and production.

The government issued an investment policy upon which Guyana would base its new investment law, to be enacted in mid-1988. The document stated that Guyana welcomes foreign and domestic private investment, with all areas open for investment and without restrictions on private companies or on full, foreign, private ownership of an enterprise. The Government would particularly welcome foreign private investment in exploration, development, processing, marketing, and maintaining infrastructure for bauxite, diamond, gold, manganese, petroleum, and other minerals. The Government would offer generous tax incentives to prospective investors, including the exemption of any duty for imports of machinery and equipment. This was a major change from the previous Administration, which nationalized the assets of several United States and British companies involved in bauxite, sugar, and shipping during the 1970's. The Government acknowledged that the country's infrastructure would have to be improved to attract new foreign investment.

Guyana signed cooperative agreements with Cuba and Colombia relating to scientific, technical, and economic support. Also the Government signed agreements with Cuba, Jamaica, and Venezuela to increase bilateral trade.

Caterpillar Americas, a U.S. heavy-equipment company, concluded a $4.3 million sales agreement with Guyana Mining Enterprise Ltd. (GUYMINE), the state-owned bauxite mining corporation. GUYMINE will purchase eight large earthmoving machines plus a number of spare parts. Guyana and Venezuela agreed to renew an agreement to exchange 540,000 tons per year of bauxite for 10,000 barrels per year of oil. Venezuela was also considering assisting the Bauxite Industry Development Co., a Guyana Government agency, to reopen the alumina refinery at Linden, which had closed in 1982.

A joint venture of Golden Star Resources and Placer Development Ltd. continued to explore the Omai gold deposit. Golden Star formed another joint venture with Giant Resources, an Australian holding company, to explore three other properties, Buramita, Arakaka, and Million Mountain, for gold. Engineering studies and a drilling program were being carried out by the companies to determine the best method of exploitation.

A lot of small-scale diamond operations have switched to gold mining, which caused a decline in diamond production in 1987. To overcome this, and to encourage increased production, the Government has doubled the price paid for diamonds.

PARAGUAY[5]

Paraguay's GDP increased 4.2% in 1987. The increase was attributed to an increase in the agricultural sector, which contributed about one-third of the GDP, and to increased export earnings from sales of hydroelectric power from the Itaipú station. The economy, however, continued to be affected by high inflation and limited private investment. U.S. exports to Paraguay have increased in recent years. A large portion of these were reexported by Paraguay to Argentina and Brazil. Mining continued to contribute little to the economy and was limited mostly to industrial minerals such as cement, clays, gypsum, limestone, and sand and stone.

Construction continued on the Yacyretá hydroelectric project, a joint venture between Paraguay and Argentina scheduled for completion in 1993. The 1987 budget for the project was $360 million.[6] During the year, the major work in process was the civil-works construction of the turbine powerhouse and the spillway. Priority also was given to the construction of the navigation locks and the earth dam on Yacyretá Island. At yearend, more than one-third of the required civil works was completed. In June, a $400 million turbine contract was signed. Nine of the turbines will be constructed by a U.S. firm, seven by an Argentine-Paraguayan consortium, and four by a Canadian firm. The U.S. Export-Import Bank was expected to participate in the financial plan. The Yacyretá binational board met in February and awarded a $69 million contract to a consortium of companies from Japan and the Federal Republic of Germany for the purchase and installation of the first 10 electrical generators to be connected to the turbines. The board also awarded a $66 million contract for the construction and installation of the spillway locks.

Oil exploration continued in the Chaco Boreal area. Total investment for seismic and oil drilling activities in this area had been estimated at $50 million.

Table 6.—Paraguay: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	462	521	2	Brazil 507; Uruguay 12.
Metal including alloys:				
Unwrought	20	40	--	All from Brazil.
Semimanufactures	374	347	8	Brazil 228; Argentina 70.

See footnote at end of table.

Table 6.—Paraguay: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Copper: Metal including alloys, semimanufactures	501	391	--	Chile 332; Brazil 52.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	--	52	--	All from Republic of South Africa.
Metal:				
Scrap	36	45	--	All from Brazil.
Pig iron, cast iron, related materials	40	41	--	Mainly from Brazil.
Ferroalloys	25	1	--	All from Brazil.
Steel, primary forms	9,429	10,259	--	Argentina 6,094; Brazil 3,735; Uruguay 325.
Semimanufactures:				
Bars, rods, angles, shapes, sections	7,144	7,095	--	Brazil 4,080; Argentina 1,493; Republic of South Africa 1,275.
Universals, plates, sheets	12,258	8,181	--	Brazil 5,368; Republic of South Africa 2,249; Argentina 300.
Hoop and strip	280	412	--	Brazil 366; Belgium-Luxembourg 39.
Rails and accessories	28	9	--	Mainly from United Kingdom.
Wire	192	108	--	Brazil 105; West Germany 2.
Tubes, pipes, fittings	344	4,358	2,150	Brazil 1,514; Argentina 553.
Castings and forgings, rough	858	698	5	Spain 277; Argentina 228.
Lead:				
Oxides	--	1	--	All from Argentina.
Metal including alloys, semimanufactures	--	1	--	All from France.
Manganese: Oxides	--	21	--	Peru 16; West Germany 5.
Nickel: Metal including alloys, semimanufactures value, thousands	$4	$5	--	Mainly from Argentina.
Silver: Metal including alloys, unwrought and partly wrought do.	$3	--		
Tin: Metal including alloys:				
Unwrought	--	16	15	Republic of South Africa 1.
Semimanufactures	--	1	--	All from United Kingdom.
Titanium: Oxides	362	114	--	Mexico 80; West Germany 29; Republic of South Africa 6.
Zinc:				
Oxides	20	7	--	West Germany 4; Argentina 1; Brazil 1.
Metal including alloys:				
Unwrought	44	99	--	All from Peru.
Semimanufactures	--	16	--	All from Brazil.
Other: Oxides and hydroxides	--	11	--	NA.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	40	16	--	Brazil 14; West Germany 2.
Asbestos, crude	597	307	--	Brazil 288; Canada 18.
Boron materials: Crude natural borates	2	--		
Cement	122,334	89,506	70	Argenitina 57,476; Brazil 31,960.
Chalk	75	15	--	All from Argentina.
Clays, crude	1,441	346	173	Argentina 136; Brazil 22.
Fertilizer materials:				
Crude, n.e.s	15,132	7,159	--	Brazil 6,803; Uruguay 356.
Manufactured:				
Ammonia	77	24	--	Brazil 17; Belgium-Luxembourg 5.
Nitrogenous	2,453	2,138	--	Brazil 2,094; Belgium-Luxembourg 25.
Phosphatic	9,360	11,731	18	Brazil 10,507; Uruguay 608; West Germany 573.
Potassic	770	1,634	--	Uruguay 1,104; Brazil 530.
Graphite, natural	3	--		
Gypsum and plaster	6,003	8,858	--	All from Argentina.
Magnesium compounds: Magnesite, crude	20	--		
Mica: Crude including splittings and waste	--	18	--	Do.
Nitrates, crude	14	13	--	West Germany 11; Argentina 1.
Phosphates, crude	71	83	--	Republic of South Africa 50; West Germany 15.
Salt and brine	11,266	3,898	--	Argentina 3,650; Bolivia 150; Brazil 97.
Sodium compounds, n.e.s.: Carbonate, manufactured	2,395	2,573	9	Spain 1,368; Romania 666; Brazil 279.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	543	278	--	Brazil 270; Argentina 8.
Worked	201	222	--	Brazil 97; Italy 97; Uruguay 28.
Sand other than metal-bearing	53	8	--	Brazil 6; Argentina 2.

See footnotes at end of table.

Table 6.—Paraguay: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Sulfur:				
Elemental:				
Crude including native and by-product	862	1,198	127	Uruguay 686; West Germany 291.
Colloidal, precipitated, sublimed	707	289	--	West Germany 159; Argentina 130.
Sulfuric acid	458	338	--	Uruguay 322; Brazil 15.
Talc, steatite, soapstone, pyrophyllite	404	186	2	Argentina 94; Brazil 90.
Other: Crude	24	46	--	All from Brazil.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	8,241	7,309	--	Brazil 4,131; Argentina 3,178.
Carbon black	6	7	--	West Germany 4; Argentina 1; Brazil 1.
Coal:				
Briquets of anthracite and bituminous coal value, thousands	$11	--		
All grades excluding briquets	--	57	--	All from Brazil.
Coke and semicoke	30	25	--	All from Argentina.
Petroleum:				
Crude 42-gallon barrels	1,197,385	1,555,744	7	Algeria 1,295,904; Argentina 259,833.
Refinery products:				
Liquefied petroleum gas do	320,844	310,939	--	Argentina 196,643; Brazil 114,295.
Gasoline, motor do	418,404	489,107	--	Brazil 317,806; Argentina 171,300.
Mineral jelly and wax do	889	614	94	Brazil 401; West Germany 118.
Kerosene and jet fuel do	85,824	115,793	--	Brazil 87,056; Argentina 28,745.
Distillate fuel oil do	1,305,642	1,582,728	--	Argentina 1,110,458; Brazil 472,263.
Lubricants do	1,568	308	--	Argentina 126; Brazil 98.
Nonlubricating oils do	26,894	31,892	1,393	Argentina 14,406; United Kingdom 4,564; Netherlands 4,046.
Residual fuel oil do	20,513	41,698	--	Brazil 21,665; Argentina 20,033.
Bitumen and other residues do	16,810	16,495	--	Argentina 13,968; Brazil 2,533.
Bituminous mixtures do	37,033	13,368	--	Argentina 8,999; Brazil 4,369.

NA Not available.

[1]Table prepared by Linda Williams. Detailed export data for 1985 and 1986 were not available at the time of publication.

SURINAME[7]

The economy of Suriname was highly dependent on bauxite. The mining and processing of bauxite accounted for 7% of the GDP and 75% of exports in 1987. Despite reserves of about 400 million tons, production and exports of bauxite had been declining since 1980. The Suriname Government drafted a revised mining code to attract foreign investment. Also, the Government was interested in encouraging the development of the country's copper, gold, and kaolin deposits.

Bauxite production in Suriname was the responsibility of Suriname Aluminum Co. (SURALCO), a wholly owned subsidiary of Aluminum Co. of America (Alcoa) and NV Billiton Maatschappij Suriname (BMS). SURALCO reported a drop of 28% in the overall production of bauxite, alumina, and aluminum exports as a result of insurgencies. Aluminum shipments were down from 29,512 tons in 1986 to 3,158 tons in 1987. Bauxite exports were down from 326,600 tons in 1986 to zero. However, alumina exports increased more than 8% in 1987.

Suriname's bauxite industry was confronted by two primary problems. The first was the damages and losses caused by local insurgents. In January 1987, insurgents blew up transmission towers and cut electrical power lines to SURALCO's Paranam aluminum smelter. In February, the alumina refinery was damaged. By April, alumina refinery operations had resumed, but the smelter was still closed at yearend. BMS, the second operator, supplied about 45% of the feedstock for the alumina refinery from its Onverdacht and Lleydorp Mines in Suriname. The remaining bauxite requirements of the refinery were imported from the Dominican Republic and Brazil.

The second, more fundamental, problem

for Suriname's bauxite industry was to remain competitive in the depressed world market. Despite worldwide price increases in 1987, competition from cheaper sources for bauxite, alumina, and aluminum reduced demand for the relatively expensive Surinamese bauxite and its derivatives.

The state oil company, Staatsolir, continued with the development of the Barnco, Saramacca, and Tambareljo Oilfields east of Paramaribo. Oil production had been increasing as a result of increased drilling and improved recovery with steam injection. The production target for 1990 was set at 5,000 barrels per day. The major part of the oil produced went to SURALCO's aluminum plant and BMS' operations.

URUGUAY[8]

Uruguay's GDP increased about 4% in 1987. Its economy continued to be based primarily on agriculture. As the country has limited mineral resources, its mining industry is insignificant by world standards and makes a minor contribution to the country's economy. Uruguay's mineral-related output continued to be limited to corundum, steel products, industrial minerals, and petroleum products processed from imported crude oil. The construction sector continued the upward trend that began in 1986 after a decline from 1982 to 1984. Cement production increased 18%.

Brazil continued to be Uruguay's main trading partner, followed by the United States, Argentina, and the Federal Republic of Germany.

The Government agency, Administración Nacional de Combustibles, Alcohol y Portland (ANCAP), was to receive a $24 million[9] loan from the International Bank for Reconstruction and Development (World Bank) in 1987 for the modernization of its De la Teja oil refinery. The loan proposal had been evaluated by the World Bank in 1986. The work was to be directed toward the improvement of the refinery's ability to refine various grades of crude oil, to reduce operational costs, and to increase the refinery's capacity. The Government of Uruguay was to provide $6 million of the $30 million of the project's estimated cost. ANCAP, with a monopoly on the importation and refining of crude oil, also entered into an agreement with Mexico's state-owned oil producer, Petróleos Mexicanos (PEMEX). Uruguay would purchase its first large crude oil order, satisfying 40% of its 1987 oil requirement of 10,000 barrels per day, from PEMEX.

During 1987, Uruguay held talks with the Governments of Argentina and Brazil on importing oil from those countries in exchange for gasoline and other petroleum products.

Uruguay's Administración Nacional de Usinas y Transmisiones Eléctricas (UTE) also received a $45.2 million loan from the World Bank for the rehabilitation of its hydroelectric plant in Paso de los Toros and to assist UTE in the refinancing of its foreign debt.

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[1]Prepared by Pablo Velasco, physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Ecuadorean sucres (S) to U.S. dollars at the rate of S191=US$1.00.

[3]Prepared by Ivette E. Torres, physical scientist, Division of International Minerals.

[4]Prepared by Harold R. Newman, physical scientist, Division of International Minerals.

[5]Prepared by Ivette E. Torres, physical scientist, Division of International Minerals.

[6]Where necessary, values have been converted from Paraguayan guaranies (Gs) to U.S. dollars at the rate of Gs5.50=US$1.00.

[7]Prepared by Harold R. Newman, physical scientist, Division of International Minerals.

[8]Prepared by Ivette E. Torres, physical scientist, Division of International Minerals.

[9]Where necessary, values have been converted from Uruguayan pesos (Ur$) to U.S. dollars at the rate of Ur$226.60=US$1.00.

Table 7.—Uruguay: Exports and reexports of mineral commodities[1]

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	2	9	--	All to Paraguay.
Metal including alloys, semimanufactures	134	199	--	Argentina 119; Ecuador 26; Peru 17.
Copper: Metal including alloys:				
Unwrought	8	--		
Semimanufactures	28	28	--	Italy 21; West Germany 7.
Iron and steel: Metal:				
Steel, primary forms	2,585	323	--	All to Paraguay.
Semimanufactures:				
Bars, rods, angles, shapes, sections	7,005	9,087	1,965	Argentina 7,025; Paraguay 97.
Universals, plates, sheets	550	705	588	Chile 84; Argentina 33.
Hoop and strip	--	133	--	All to Argentina.
Wire	2,048	2,549	--	Argentina 2,404; Brazil 145.
Tubes, pipes, fittings	410	575	--	Argentina 437; Brazil 110; Chile 28.
Lead: Metal including alloys:				
Unwrought	--	60	NA	NA.
Semimanufactures	20	--		
Zinc:				
Oxides	146	223	--	Brazil 165; Argentina 36; Netherlands 22.
Metal including alloys:				
Unwrought	5	--		
Semimanufactures	4	--		
INDUSTRIAL MINERALS				
Cement	45	3,060	--	All to Brazil.
Clays, crude	20	--		
Fertilizer materials: Manufactured:				
Nitrogenous	300	--		
Phosphatic	7,001	27,366	--	Brazil 24,082; Argentina 3,284.
Potassic	680	60	--	All to Argentina.
Unspecified and mixed	3,476	3,950	--	Paraguay 3,450; Brazil 500.
Lime	--	105	--	All to Argentina.
Precious and semiprecious stones other than diamond: Natural value, thousands	$310	$348	$205	West Germany $72; Japan $18.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	17	30	NA	NA.
Sulfate, manufactured	2,766	4,495	--	Brazil 1,400; Argentina 1,221; Peru 944.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	3,425	5,614	--	Japan 3,298; Italy 1,313; Spain 495.
Worked	521	535	37	Belgium-Luxembourg 425; Argentina 72.
Dolomite, chiefly refractory-grade	405	--		
Gravel and crushed rock	12,700	34,640	--	All to Argentina.
Sand other than metal-bearing	117,723	195,288	--	Do.
Sulfur:				
Elemental: Crude including native and byproduct	298	388	--	All to Paraguay.
Sulfuric acid	7,912	13,505	--	Brazil 7,481; Argentina 5,626; Paraguay 368.
Talc, steatite, soapstone, pyrophyllite	87	50	--	All to Argentina.
Other: Slag and dross, not metal-bearing	--	20	--	Do.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline, motor--42-gallon barrels	--	85,179	--	All to Brazil.
Lubricants--do	140	273	--	Brazil 147; Peru 77; Argentina 28.
Bituminous mixtures--do	--	230	--	All to Brazil.

NA Not available.
[1]Table prepared by Linda Wiliams.

Table 8.—Uruguay: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	1,911	3,951	--	All from Brazil.
Oxides and hydroxides	697	1,203	2	West Germany 638; Brazil 532; United Kingdom 30.
Metal including alloys:				
Unwrought	1,474	1,991	--	Argentina 1,039; Brazil 952.
Semimanufactures	801	371	1	Argentina 168; Brazil 92; Italy 80.
Chromium:				
Ore and concentrate	4	4	--	All from Brazil.
Oxides and hydroxides	9	1,013	(2)	Brazil 1,006; West Germany 6.
Cobalt: Oxides and hydroxides value, thousands	$2	$2	--	All from China.
Copper: Metal including alloys:				
Unwrought	1	10	--	All from Peru.
Semimanufactures	251	1,733	5	Chile 1,205; Brazil 280; Peru 100.
Iron and steel: Metal:				
Scrap	9	--		
Pig iron, cast iron, related materials	262	570	(2)	Argentina 520; Brazil 48.
Ferroalloys:				
Ferromanganese	113	299	--	Brazil 295; West Germany 4.
Unspecified	507	518	--	Brazil 505; West Germany 10; Argentina 2.
Steel, primary forms	458	12,520	--	Argentina 12,320; Brazil 200.
Semimanufactures:				
Bars, rods, angles, shapes, sections	7,123	11,285	--	Argentina 5,714; Brazil 4,247; Republic of South Africa 603.
Universals, plates, sheets	2,393	15,707	220	Brazil 13,349; Republic of South Africa 522; Belgium-Luxembourg 519.
Hoop and strip	885	924	3	Brazil 453; West Germany 341; Argentina 106.
Rails and accessories	12	98	--	All from Spain.
Wire	961	1,441	NA	Argentina 477; Brazil 380; Japan 202.
Tubes, pipes, fittings	NA	269	2	Brazil 171; Argentina 54; West Germany 22.
Lead:				
Oxides	47	3,107	--	Mexico 3,025; Argentina 82.
Metal including alloys, unwrought	879	1,312	--	Mexico 1,172; Argentina 90; West Germany 50.
Magnesium: Metal including alloys:				
Unwrought	6	1	--	All from France.
Semimanufactures	9	9	3	Italy 4; Canada 1.
Manganese: Oxides	12	12	--	West Germany 11; Brazil 1.
Mercury 76-pound flasks	29	145	NA	Japan 58; Mexico 58.
Molybdenum: Metal including alloys, all forms	60	NA		
Nickel: Metal including alloys:				
Unwrought	8	8	--	All from Canada.
Semimanufactures	8	15	NA	Austria 6; Canada 5; France 2.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, platinum value, thousands	$10	--		
Silver: Metal including alloys, unwrought and partly wrought do.	$9	$1	$1	
Tin: Metal including alloys:				
Scrap	--	1	--	All from Brazil.
Unwrought	16	29	--	Mainly from Brazil.
Semimanufactures	NA	2	--	Brazil 1; Japan 1.
Titanium: Oxides	153	30	1	United Kingdom 26; West Germany 3.
Tungsten: Metal including alloys, all forms value, thousands	$1	$6	--	West Germany $4; United Kingdom $2.
Zinc:				
Oxides	18	121	7	Mexico 108; France 3.
Metal including alloys:				
Unwrought	698	1,497	--	Mexico 1,364; Argentina 70; Peru 60.
Semimanufactures	37	41	3	Brazil 11; West Germany 10; Belgium-Luxembourg 8.
Other:				
Ores and concentrates	10	10	--	All from United Kingdom.
Oxides and hydroxides	9	11	4	West Germany 5; Brazil 2.
Base metals including alloys, all forms	--	4	--	Japan 2; U.S.S.R. 2.

See footnotes at end of table.

Table 8.—Uruguay: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	10	111	9	Argentina 78; Netherlands 16.
Artificial: Corundum	98	85	1	Brazil 84.
Grinding and polishing wheels and stones value, thousands	$247	$306	$27	Brazil $62; Japan $40; Spain $39.
Asbestos, crude	814	1,003	--	Brazil 581; Canada 191; Zimbabwe 120.
Barite and witherite	17	22	--	All from Argentina.
Boron materials:				
Crude natural borates	131	306	--	Do.
Oxides and acids	87	227	5	Argentina 215; West Germany 4.
Cement	38	646	--	Argentina 502; Netherlands 100; France 32.
Chalk	5	12	7	Argentina 5.
Clays, crude	NA	4,686	386	Brazil 3,476; Argentina 814.
Cryolite and chiolite value, thousands	$1	--		
Diamond: Gem, not set or strung do	$4	--		
Diatomite and other infusorial earth	104	62	1	Argentina 42; Brazil 12; Mexico 7.
Feldspar, fluorspar, related materials	10	31	--	Argentina 21; United Kingdom 10.
Fertilizer materials: Manufactured:				
Ammonia	274	543	--	Argentina 405; Brazil 132; West Germany 4.
Nitrogenous	32,367	53,219	1,000	Romania 22,748; Brazil 13,238; Mexico 5,400.
Phosphatic	11,813	20,835	17,960	Brazil 2,875.
Potassic	6,190	6,536	--	West Germany 5,205; Brazil 1,330; Switzerland 1.
Unspecified and mixed	42,007	42,648	37,725	Morocco 4,000; Belgium-Luxembourg 498.
Graphite, natural	47	29	--	Brazil 20; West Germany 9.
Gypsum and plaster	673	960	--	Argentina 560; West Germany 400.
Magnesium compounds: Magnesite, crude	40	46	1	Brazil 23; West Germany 16; Netherlands 3.
Mica:				
Crude including splittings and waste	18	39	9	Brazil 25; Argentina 3.
Worked including agglomerated splittings	2	2	--	Brazil 1; Spain 1.
Nitrates, crude	330	312	--	All from Chile.
Phosphates, crude	39,500	35,422	--	Togo 16,000; Tunisia 11,414; Senegal 8,008.
Pigments, mineral: Iron oxides and hydroxides, processed	106	171	1	West Germany 81; Argentina 78; Spain 10.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$3	$12	$6	Brazil $6.
Synthetic do	$5	$16	$8	Switzerland $8.
Pyrite, unroasted	--	2	2	
Salt and brine	55,923	76,801	21	Chile 65,099; Spain 11,300; Argentina 260.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	6,656	11,648	--	Spain 10,234; East Germany 978; West Germany 435.
Sulfate, manufactured	NA	2,196	--	Chile 1,801; Brazil 136; West Germany 121.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	373	21,264	--	Argentina 21,031; Brazil 233.
Worked	21	14	--	Italy 13; West Germany 1.
Dolomite, chiefly refractory-grade	225	105	--	All from Brazil.
Quartz and quartzite	31	--		
Sand other than metal-bearing	NA	20	--	All from Argentina.
Sulfur:				
Elemental:				
Crude including native and by-product	15,629	24,684	19,633	Canada 5,044; West Germany 7.
Colloidal, precipitated, sublimed	13	8	--	Argentina 5; United Kingdom 3.
Sulfuric acid value, thousands	$1	$2	--	West Germany $1; Spain $1.
Talc, steatite, soapstone, pyrophyllite	11	63	59	West Germany 2; Switzerland 1.
Other: Crude	247	194	--	Republic of South Africa 95; Mexico 35; Argentina 25.

See footnotes at end of table.

Table 8.—Uruguay: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1	1	1	
Carbon black	NA	2,363	13	Argentina 1,488; Mexico 557; Brazil 280.
Coal:				
Briquets of anthracite and bituminous coal	--	4	--	All from Argentina.
All grades excluding briquets	500	500	--	All from Poland.
Coke and semicoke	85	2	--	All from Argentina.
Peat including briquets and litter	5	18	--	Do.
Petroleum:				
Crude thousand 42-gallon barrels	7,908	9,917	--	Mexico 3,555; United Arab Emirates 1,976; Nigeria 1,506.
Refinery products:				
Liquefied petroleum gas do	--	[3]25	--	All from Brazil.
Gasoline, motor do	5	162	--	Argentina 137; Netherlands 22; Brazil 3.
Mineral jelly and wax do	6	6	(2)	Argentina 3; Brazil 2.
Kerosene and jet fuel do	(2)	26	--	Mainly from Brazil.
Distillate fuel oil do	--	476	--	All from Brazil.
Lubricants do	115	153	14	Argentina 49; Netherlands 34; Brazil 25.
Residual fuel oil do	265	217	--	All from Brazil.
Bitumen and other residues do	(2)	--		
Bituminous mixtures do	(2)	(2)	--	Mainly from Argentina.
Petroleum coke do	13	18	--	All from Argentina.

NA Not available.
[1]Table prepared by Linda Williams.
[2]Less than 1/2 unit.
[3]May include natural gas.

The Mineral Industry of Other South Pacific Islands

By Travis Q. Lyday[1]

CONTENTS

INTRODUCTION

The Other South Pacific Island states extend from Palau, also called Belau, near the Philippines in the west, to French Polynesia in the east. However, a number of countries and territories have been omitted from this chapter because their mineral production was insignificant to the local economy. These include the French overseas territories of French Polynesia and Wallis and Futuna Islands; independent states, including Kiribati, Marshall Islands, Micronesia, Palau, Tonga, Tuvalu, and Vanuatu; the New Zealand freely associated state of the Cook Islands, and the New Zealand dependency of Niue. What mineral production existed in these islands was limited to construction materials such as coral reef limestone, crushed stone, and sand and gravel in minor quantities solely for domestic consumption.

FIJI

The mineral industry of Fiji continued to be dominated by gold, although this sector contributed less than 1% to the gross domestic product (GDP) of the country. Gold and silver together ranked second in value among the country's exports. Fiji's economy contracted 11% during the 8-month period following the first, on May 14, of two military coups. Although the island nation had been a member of the British Commonwealth of Nations since its independence on October 10, 1970, Fiji's membership terminated with the emergence of the Republic of Fiji on October 15.

The main mineral resources of Fiji were gold-silver telluride deposits, porphyry copper and volcanogenic base metal deposits, residual bauxite and phosphate deposits, and heavy-mineral sands. Manganese had been mined on a small scale.

The largest and most important mining operation in Fiji was the Vatukoula gold-silver mine in the north of the main island of Viti Levu. The mine, also called the Emperor, also had produced significant amounts of tellurium in the past. The Vatukoula Mine was managed and operated by Western Mining Corp. (Fiji) Ltd. (WMCF), a

wholly owned subsidiary of Western Mining Corp. Holdings Ltd. of Australia, in joint venture with Emperor Gold Mining Co. Ltd. WMCF held a 20% interest in the Vatukoula Mine.

The Vatukoula operation continued as Fiji's only metallic mineral producer in 1987, mining by both open cut and underground methods, with 60% of the ore mined underground. The mine produced more than 100,000 troy ounces of gold in the 12 months ending June 30, 1987, the first time that figure had been reached since 1970. Profits for the period were $14.6 million[2] compared with $2 million in fiscal year 1986.

Other active mining in Fiji included quarries for stone and crushed gravel, limestone for cement and lime production, and coral and river sand dredging, all exclusively for domestic use.

Several major mining firms continued to explore for minerals, especially gold, throughout Fiji. A number of small high-grade epithermal deposits were under evaluation, although no major discoveries had been announced by yearend.

Freeport-McMoRan Australia Ltd. explored for epithermal gold on the islands of Kadavu and Ono during the year, reporting assays as high as 0.17 ounce of gold per short ton and up to 7 ounces of silver per short ton on Ono, with gold values up to 0.06 ounce of gold per short ton on eastern Kadavu.

United Resources (Fiji) Ltd., a wholly owned subsidiary of the Australian mining company City Resources Ltd., applied for Special Prospecting Licenses (SPL) covering most of the Yasawa Islands northwest of Viti Levu as a result of encouraging stream sediment samples obtained in a regional reconnaissance program.

Another Australian company, Solomon Pacific Resources NL, conducted a channel sampling and drilling program at former underground workings at the Wainivesi gold prospect, 70 kilometers north of Suva. Solpac (Fiji) Ltd., a wholly owned subsidiary, earned a 90% interest in the property from the joint-venture partner Geopacific Ltd.

Australian-based Climax Mining Ltd. completed its program of reverse circulation percussion drilling at its Faddy gold prospect in the Mistry SPL on Viti Levu, 16 kilometers south of Nadi. Results showed a significant gold sulfide-bearing zone of 2 million tons of probable ore grading 0.06 ounce of gold per short ton. Preliminary metallurgical testing on samples from a section of the sulfide mineralization obtained +90% gold recoveries with low cyanide consumption.

Pacific Islands Gold (Fiji) Ltd., a wholly owned subsidiary of Pacific Islands Gold NL, signed a joint-venture agreement with Climax Mining. Under the agreement Climax Mining will operate Pacific Islands' (Fiji) 1,320-hectare Koroisa SPL, adjacent on the south to Climax Mining's Mistry SPL about 20 kilometers south of Nadi, and can earn a 50% interest in the property. Pacific Islands (Fiji) and Climax Mining also filed an application for an SPL immediately south of the Koroisa SPL.

In midyear, the close-spaced diamond-drilling exploration on the Mount Kasi gold prospect in southwestern Vanua Levu yielded higher data about probable reserves. The program was a joint venture by Newmont Pty. Ltd., 65%, and Range Resources Ltd., 35%. The initial estimate had been 370,000 tons of ore grading 0.13 ounce of gold per short ton. New assay results indicated varying intervals of gold mineralization, ranging up to 0.25 ounce of gold per short ton over a 25-meter interval in one hole. The drilling was originally to delineate reserves for a proposed 50,000-ton-per-year open pit, but by yearend, the venture was considering a 1.0- to 1.5-million-ton-per-year pit, mining both hard rock and eluvial material. The eluvial portion was reported to contain 1.8 million tons of ore grading 0.05 ounce of gold per short ton, recoverable with cyanide and without crushing or grinding. The reserve and grade of the hard-rock portion of the ore body were not available.

Pacific Islands (Fiji) reportedly discovered an extensive zone of epithermal gold mineralization on the 4,500-hectare Dakuniba SPL in southeastern Vanua Levu. Up to 0.31 ounce of free-milling gold per short ton was obtained from rock chip and float sampling. United Resources was to provide $170,500 to initiate a major drilling program in early 1988 to assess the prospect as well as earn a 50% interest in the SPL.

Japan and France planned to conduct a 5-year survey of the sea bottom, at least 3,000 meters deep, in the southwestern Pacific Ocean near Fiji. The objective was the search for hydrothermal base metal deposits.

Approximately 60% of Fiji was covered by SPL's in 1987.

Table 1.—Other South Pacific Islands: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Area and commodity	1983	1984	1985	1986[p]	1987[e]
FIJI					
Cement, hydraulic	109,900	97,900	93,200	92,278	95,000
Gold, mine output, Au content troy ounces	40,124	48,515	60,707	94,902	85,000
Lime[2]	[e]2,500	[e]2,500	3,261	2,305	2,000
Silver, mine output, Ag content troy ounces	13,021	15,207	14,198	17,062	16,000
Stone, sand and gravel:[e]					
Coral sand for cement manufacture	95,000	95,000	126,500	160,900	170,000
River sand for cement manufacture	28,000	25,000	40,000	39,500	40,000
River sand and gravel, n.e.s. cubic meters	375,000	350,000	1,200,000	577,500	600,000
Quarried stone do.	225,000	225,000	105,030	160,000	150,000
NAURU[3]					
Phosphate rock thousand tons	1,684	1,358	1,508	1,494	[4]1,376
NEW CALEDONIA					
Cement	[e]60,000	[e]60,000	[e]60,000	40,000	50,000
Chromite, gross weight	91,380	84,152	149,476	163,325	152,756
Cobalt, mine output:					
Content by analysis[5]	1,540	2,006	2,541	2,187	1,953
Recovered[6]	161	103	124	105	96
Nickel:					
Ore:					
Gross weight thousand tons	2,200	2,886	3,600	3,125	[4]2,790
Ni content	46,162	58,326	72,360	61,800	56,100
Metallurgical products:					
Ferronickel:					
Gross weight[e]	84,700	113,700	140,800	[4]130,500	115,600
Metal content (nickel plus cobalt)	21,717	29,158	36,103	33,001	[4]29,531
Nickel matte:					
Gross weight[e]	6,200	7,600	12,100	12,260	11,300
Metal content (nickel plus cobalt)	4,578	5,462	8,905	9,160	[4]8,283
Stone, sand and gravel:[e]					
Stone:					
Crude (unspecified) cubic meters	19,000	20,000	20,000	20,000	20,000
Crushed do.	90,000	90,000	90,000	100,000	100,000
Sand do.	60,000	60,000	60,000	75,000	75,000
Silica (for metallurgical use) do.	15,000	15,000	15,000	15,000	15,000
PAPUA NEW GUINEA[3]					
Copper, mine output, Cu content	201,876	164,447	175,048	178,211	[4]217,699
Gold, mine output, Au content troy ounces	579,407	[e]835,000	1,186,618	1,127,686	[4]1,069,011
Silver, mine output, Ag content do.	1,524,360	1,427,491	1,482,533	1,787,000	1,963,315
SOLOMON ISLANDS[3]					
Gold, mine output, Au content do.	[e]1,100	2,572	[e]2,090	[e]4,000	4,000
Silver, mine output, Ag content do.	[e]250	--	--	--	--

[e]Estimated. [p]Preliminary.

[1]Table includes data available through August 1, 1988.

[2]Produced from an unreported amount of domestically quarried limestone.

[3]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.

[4]Reported figure.

[5]Cobalt content of nickel ores computed assuming average cobalt content to be 0.07%.

[6]Cobalt actually recovered for use as cobalt; excludes cobalt content of nickel-cobalt alloys and/or included in ferronickel.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Principal destinations, 1985
METALS			
Aluminum: Metal including alloys:			
Scrap	33	33	Australia 10; New Zealand 10.
Unwrought and semimanufactures	--	19	Mainly to Hong Kong.
Copper: Metal including alloys:			
Scrap	180	143	All to Australia.
Semimanufactures	--	30	Mainly to Australia.
Iron and steel: Metal:			
Scrap	1,810	717	New Zealand 558.
Steel, primary forms	--	2	All to unspecified Oceania.
Semimanufactures[2]	521	363	Tonga 168; American Samoa 52; New Zealand 35.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Principal destinations, 1985
METALS —Continued			
Lead: Metal including alloys, scrap	34	18	All to New Zealand.
Silver:			
Waste and sweepings value, thousands	$2	--	
Metal including alloys, unwrought and partly wrought do	$123	$89	All to Australia.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.: Grinding and polishing wheels and stones value, thousands	$4	--	
Cement	4,566	8,300	Samoa 3,121; Tonga 2,958; American Samoa 1,602.
Clays, crude	1	--	
Salt and brine	129	--	
Stone, sand and gravel:			
Gravel and crushed rock	--	131	Australia 126.
Sand other than metal-bearing	--	2	NA.
Other: Slag and dross, not metal-bearing	--	13	All to Australia.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Liquefied petroleum gas 42-gallon barrels	58	35	Tuvalu 23.
Gasoline do	149,660	134,351	Tonga 37,740; Samoa 26,240; Cook Islands 19,873.
Kerosene and jet fuel do	714,783	743,264	Cook Islands 33,472; Tonga 29,721; ship stores 604,252.
Lubricants do	2,065	1,225	New Zealand 168; Tuvalu 119; ship stores 637.
Residual fuel oil do	299,314	331,295	Tonga 61,732; Samoa 55,131; ship stores 130,956.
Unspecified do	6	--	

NA Not available.

[1]Table prepared by Audrey D. Wilkes. Fiji did not report any exports of mineral commodities to the continental United States during 1985.

[2]Totals exclude unreported quantities valued at $40,000 in 1984 and $12,000 in 1985.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys, all forms	562	541	(2)	New Zealand 441; Australia 60.
Copper: Metal including alloys, all forms	99	118	5	Australia 55; New Zealand 36.
Iron and steel: Metal:				
Pig iron, cast iron, related materials	73	36	--	Japan 31.
Ferroalloys	1	3	--	All from New Zealand.
Steel, primary forms	12,909	9,242	1	Australia 5,824; New Zealand 2,766.
Semimanufactures:				
Bars, rods, angles, shapes, sections	4,788	6,386	61	New Zealand 2,538; Japan 1,656; Hong Kong 795.
Universals, plates, sheets	11,803	12,367	7	Australia 6,067; New Zealand 3,554; Japan 1,748.
Hoop and strip	402	421	--	Australia 318; New Zealand 80.
Rails and accessories value, thousands	$69	$271	--	United Kingdom $113; Japan $97.
Wire	2,150	2,375	--	Australia 1,920; New Zealand 301.
Tubes, pipes, fitting[3]	2,114	3,447	--	Australia 1,371; Japan 484; New Zealand 183.
Castings and forgings, rough	1	--		
Lead:				
Oxides	81	42	--	Australia 26; West Germany 11.
Metal including alloys, unwrought and semimanufactures value, thousands	$32	$47	--	New Zealand $15; United Kingdom $14; Australia $13.
Silver: Metal including alloys, unwrought and partly wrought do	$8	$4	--	Australia $3.
Tin: Metal including alloys, all forms do	$2,433	$1,535	--	Japan $1,532.
Titanium: Oxides	254	359	73	Australia 285.
Zinc: Metal including alloys, all forms	32	(4)	--	Mainly from Australia.
Other: Ores and concentrates	15	--		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	43	58	--	New Zealand 37; Australia 21.
Grinding and polishing wheels and stones value, thousands	$70	$93	$2	New Zealand $37; Australia $29.
Barite and witherite	25	76	--	New Zealand 73.
Boron materials: Crude natural borates	1	--		
Cement	3,492	6,069	--	Australia 5,504.
Clays, crude	42	83	11	New Zealand 31; Australia 21.
Diatomite and other infusorial earth	104	58	17	Australia 22; Japan 19.
Fertilizer materials:				
Crude, n.e.s	5	26	--	All from New Zealand.
Manufactured:				
Nitrogenous	59,376	30,598	--	Republic of Korea 18,583; Japan 9,851.
Phosphatic	13,887	4,689	--	Republic of Korea 3,005; Japan 1,050.
Potassic	5,835	1,792	--	Republic of Korea 1,132; Singapore 500.
Unspecified and mixed	464	1,228	--	West Germany 535; New Zealand 342.
Graphite, natural	1	--		
Gypsum and plaster	5,040	40	--	Australia 24; New Zealand 16.
Lime	170	287	--	All from New Zealand.
Magnesium compounds: Magnesite, crude including calcined	2	3	--	All from Australia.
Mica:				
Crude including splittings and waste	3	19	--	All from New Zealand.
Worked including agglomerated splittings value, thousands	$1	$7	--	China $2; Australia $1.
Nitrates, crude	36	107	54	Australia 36.
Potassium salts, crude	11	--		
Salt and brine	3,425	2,769	11	West Germany 2,459.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	15	43	--	Australia 28; India 13.
Worked value, thousands	$35	$32	--	New Zealand $15; Australia $8.
Gravel and crushed rock	17	22	--	Australia 17.
Limestone other than dimension	6	10	--	All from New Zealand.
Quartz and quartzite	2	--		
Sand other than metal-bearing	69	30	--	New Zealand 25.
Sulfur:				
Elemental:				
Crude including native and by-product	3	--		
Colloidal, precipitated, sublimed	1	1	--	All from Australia.
Sulfuric acid	125	68	--	New Zealand 41; Australia 27.
Talc, steatite, soapstone, pyrophyllite	92	70	--	Australia 36; New Zealand 34.
Other:				
Crude	93	204	--	New Zealand 145.
Slag and dross, not metal-bearing	1	(5)	--	All from New Zealand.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2,313	2,199	--	Hong Kong 2,000.
Carbon black value, thousands	$172	$48	$8	Australia $27; United Kingdom $10.
Coal, all grades including briquets	22,343	16,453	(2)	Mainly from Australia.
Coke and semicoke	2	6	--	Australia 5.
Peat including briquets and litter	5	5	--	All from New Zealand.
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	44,857	46,191	--	Australia 46,180.
Gasoline do.	532,942	537,931	--	Australia 427,746; Singapore 109,871.
Mineral jelly and wax do.	362	637	--	China 472; Australia 87.
Kerosene and jet fuel do.	852,516	945,384	--	Australia 699,639; Singapore 245,567.
Lubricants do.	25,837	25,501	--	Australia 20,552.
Residual fuel oil do.	1,020,112	1,124,081	--	Australia 991,288; Singapore 132,794.
Bitumen and other residues do.	6	36	--	New Zealand 24.
Bituminous mixtures do.	279	133	--	United Kingdom 73; New Zealand 30.

[1]Table prepared by Audrey D. Wilkes.
[2]Less than 1/2 unit.
[3]Totals exclude unreported quantities valued at $722,000 in 1984 and $630,000 in 1985.
[4]Unreported quantity valued at $133,000.
[5]Unreported quantity valued at $3,000.

NAURU

The Nauruan economy continued to be based on extensive high-grade phosphate deposits on the central plateau of the island, although annual production continued to fall because of increased competition from Jordan and Morocco. The phosphate had a guaranteed content of 84% BPL (bone phosphate of lime or tricalcium phosphate), equivalent to 38.5% phosphorus pentoxide (P_2O_5). It was the highest grade phosphate rock available to industry.

Nauru's sole export remained phosphate, mined and marketed by the Nauru Phosphate Corp. (NPC), an agency of the Government of Nauru. NPC assumed full control of the phosphate industry from the British Phosphate Commission (BPC) shortly after independence was achieved in 1968. However, BPC, headed by representatives of Australia, New Zealand, and the United Kingdom, was not terminated until early February 1987 at an official ceremony in Canberra, Australia.

The Government formed an independent commission in February, the Nauru Rehabilitation Inquiry, which was empowered to examine two issues: who was responsible for rehabilitating the land worked out by phosphate mining before independence, and the feasibility and cost of such rehabilitation. The commission was formed to persuade, or force, the BPC members to accept some of the responsibility for restoring the island, now more than 75% devastated. The commission was to send its recommendations to the Government in 1988. The Government then would decide whether to initiate any compensation claims under international law. Investments in nonmining activities over the years, along with interest payments received, have accrued the BPC an estimated $35 million.[3] If the Government determines that reparations for past mining are appropriate, it would seek a portion of these funds, reportedly about $21 million.

Production of phosphate rock in 1987, mined by clamshell buckets from deposits interdigitated with evenly spaced dolomitized coral limestone pinnacles, decreased 8%. All production was exported to Australia (see table 1). Coral mined with the phosphate was removed by hand for domestic use as road aggregate.

Table 4.—Nauru: Exports of phosphate rock, by destination

(Thousand metric tons)

Destination	1985	1986	1987
Australia	925.0	869.4	1,061.9
Japan	--	--	4.3
Korea, Republic of	14.0	22.1	38.2
New Zealand	339.6	132.7	202.9
Philippines	229.7	469.3	68.2
Total	1,508.3	1,493.5	1,375.5

Source: Phosphate Rock Statistics, International Fertilizer Industry Association Ltd.

NEW CALEDONIA

The mineral industry in the French Territory of New Caledonia and Dependencies continued to be dominated by the mining of nickel from lateritic ore and the subsequent production of ferronickel of various grades and of nickel matte; chromite produced from extensive ultramafic rock; and certain pit and quarry construction materials. However, the island territory is well endowed with additional resources; significant prospects have been reported for antimony, copper, gold, iron ore, lead-zinc, manganese, and phosphate. None has been mined commercially.

LeNickel-SLN, a wholly owned subsidiary of France's Société Métallurgique le Nickel, mined nickel at Kouaoua (Meaba Mine) and Thio (Camp des Sapins and Le Plateau Mines) on the east coast of the island of New Caledonia and produced ferronickel and nickel matte at its Doniambo smelter at Noumea.

LeNickel-SLN continued to smelt most of the company's own nickel ore, but it shipped some material to Japan for processing and smelting and about 30,000 tons of ore to Australia's Dallhold Investments Pty. Ltd.'s Yabulu smelter at Townsville, Queensland. The 52,000-ton-per-year Doniambo smelter also processed ore from smaller, independently owned mines. Minor amounts of cobalt were recovered from exports of nickel matte refined in Le Havre, France.

In December, the Japanese Government altered its general preferential tariff system to raise the ceiling on imports of nickel ore from New Caledonia. New Caledonia was reclassified as a separate country under a new system that would allow imports at a lower tariff. The new system was to go into effect April 1, 1988. The ceiling on nickel ore from New Caledonia was raised from 3.8 million to 5.6 million tons per year.

LeNickel closed down one of its three electric furnaces at the Doniambo smelter

in midyear for 4 months of maintenance, reducing contained nickel output by more than 4,000 tons to 37,814 tons. LeNickel announced in September plans to return to full operational capacity in 1988 with a production target of 45,000 tons of contained nickel. LeNickel last reached maximum output in 1985, despite sabotage at LeNickel mines and work stoppages by separatist Melanesian Kanaks. LeNickel also continued reducing costs by trimming 250 personnel, to about 2,050, during the year. Wage rates were about 15% higher in New Caledonia than in Canada, the world's largest nickel producer.

Cromical S.A. produced refractory-grade (low-silica, high-grade fines) chromite ore in addition to high-grade lumpy ore and high-grade fines from its underground Tiebaghi Mine in the northern part of the island of New Caledonia. Proven reserves were sufficient for at least 3 years of operation.

Australmin Pacific Ltd. conducted offshore drilling at its Baie des Pirgues chromite prospect, identifying an alluvial resource of 230 million tons of ore at a grade of 3.5% Cr_2O_3. The prospect is in shallow water sediments along the southwestern coast of the main island, approximately 30 kilometers southeast of Noumea. Additional drilling identified that chromite resources in the adjacent Baie des Ngo and Baie des Ouie.

PAPUA NEW GUINEA

Although Papua New Guinea has immense natural resources, including minerals, its economy remained basically agrarian, depending chiefly on cocoa, coffee, copra, and palm oil. Agriculture accounted for about one-third of both the GDP, estimated to be $2.5 billion,[4] and foreign exchange earnings from exports. However, the country's mineral industry was the second most important sector of the economy in 1987, accounting for about one-fifth of the GDP and more than one-half of total export receipts.

Comprehensive mineral exploration in Papua New Guinea since the late 1960's has resulted in the development of two major mines and the discovery of several promising prospects. The first mine to be developed, Bougainville Copper Ltd.'s (BCL) copper-gold-silver mine at Panguna, was brought into production in 1972 on Bougainville Island, North Solomons Province. BCL was owned by CRA Ltd., 53.6%; the Papua New Guinea Government, 20%; and by public shares, 26.4%. The mine ranked as the fourth largest copper mine in the world in 1987. The Ok Tedi copper-gold-silver mine on Mount Fubilan in the Star Mountains of Western Province, 25 kilometers from the border of the Indonesian Province of Irian Jaya, began production in May 1984. Ok Tedi was owned by BHP-Utah Minerals International Inc., which also assumed direct responsibility as managing shareholder of Ok Tedi Mining Ltd. (OTML), the operating company, on October 1, and Amoco Minerals Co. (Standard Oil Co., Indiana), 30% each; a consortium of Metallgesellschaft AG and Degussa AG, 7.5% each, and the state-owned West German Development Co., 5.0%; and the Papua New Guinean Government, 20%.

The open-cut Panguna Mine is in difficult terrain about 600 meters above sea level. After milling, the concentrate is pumped 25 kilometers through a slurry pipeline to the port of Anewa where it is shipped to the Federal Republic of Germany, Japan, and Spain under long-term contracts, and to China and the Republic of Korea under short-term contracts. Contained metal in concentrate produced at the Panguna Mine in 1987 was 178,211 tons of copper, 485,090 ounces of gold, and 1,626,793 ounces of silver. Milled was 48.2 million tons of ore grading 0.41% copper, 0.1 ounce of gold per short ton, and 0.04 ounce of silver per short ton.

Bechtel Australia Pty. Ltd. started detailed engineering and earthwork construction on a $50 million, 32-kilometer, 0.86-meter-diameter gravity-flow slurry pipeline to transport mine tailings to the Solomon Sea, thus using the height of the mine site to economic advantage. Pipeline construction was scheduled to commence in late 1988. When completed in 1990, the facility will be the world's largest and longest gravity-flow slurry pipeline. Currently, the tailings are transported through a short pipeline to the upper regions of the Jaba River Valley, a method that has caused considerable sediment buildup along the river.

Recoverable ore reserves at yearend were estimated to be 533 million tons, suitable for a mine life of an additional 10 to 15 years. BCL petitioned the Government in December to lift the moratorium on minerals and petroleum exploration on Bougainville Island, imposed in 1971 when the traditional landowners on the island protested the opening of the Panguna Mine. BCL officials have said that if they are to develop another mine in the region, they must begin exploring as soon as possible. A $30 million, 35-million-ton-per-year preconcentration

screening facility was completed early in the year. This provided BCL greater flexibility in treating declining ore grades and maintaining production at competitive costs. However, the facility's performance was below target initially, and it was modified to improve its efficiency.

The Ok Tedi Mine commenced production of copper concentrate in July when its concentrator came on-stream, a year earlier than originally planned. The mine had been stockpiling ore in large quantities. The production rate of the concentrator was scheduled to increase from 27,000 tons per day at yearend to 70,000 tons per day. The mining of copper ore increased as more was exposed by the mining of the leached gold-rich capping. A second gold plant was started up in midyear, accelerating the mining of the gold cap, which would be largely depleted during the latter part of 1988. The Ok Tedi Mine produced 39,488 tons of copper, 583,921 ounces of gold, and 336,521 ounces of silver in concentrate in 1987.

In August, OTML signed an 8-year, $1.5 billion contract to supply copper concentrate to a consortium of seven Japanese trading and smelting companies that will take about 40% of Ok Tedi's output. The seven companies are Dowa Mining Co. Ltd.; Furukawa Co. Ltd.; Mitsubishi Metal Corp. Ltd.; Mitsui Mining and Smelting Co. Ltd.; Nittetsu Mining Co. Ltd.; MNC Metals and Development Co. Ltd.; and Sumitomo Metal Mining Co. Ltd. Shipments were to be 60,000 tons during 1987, 200,000 tons in 1988 and 230,000 tons per year over the succeeding 6 years. The contract would ensure continued operations at cash-short OTML and enable the Japanese firms to further diversity their supply. An additional 20% of output would be shipped to Norddeutsche Affinerie AG in the Federal Republic of Germany and about 15% would go to the Komsco smelter in the Republic of Korea. The remaining concentrate was to be sold on the spot market and to metals traders.

The first shipment of copper concentrate in bulk quantity on August 21 marked the beginning of stage II operations at Ok Tedi: the concurrent production of gold bullion and copper concentrate. The concentrate was conveyed from the mill site by a 160-kilometer slurry pipeline to the Fly River port of Kiunga where it was filtered, dried, and loaded onto barges for an 850-kilometer trip to the river's mouth. There it was transshipped to Japan and the Republic of Korea.

By December, all necessary approvals between Placer Pacific Ltd. and the Government were finalized for the imminent construction of the gold-silver mining project in eastern Misima Island, Milne Bay Province, 190 kilometers southeast of the main island of New Guinea. Under the terms of the Special Mining Lease (SML), Misima Mines Pty. Ltd., a subsidiary of Placer Pacific, was granted a 21-year right to mine. The Government was to obtain a 20% equity by providing its share of all exploration and development costs, excluding the development of the Alotau mining township for mine employees. Construction of the mine site was scheduled to start in early 1988, with plant commissioning scheduled for July 1989. Total capital investment was expected to be about $215 million. Revised estimated minable ore reserves at Misima were 56 million tons grading 0.4 ounce of gold per short ton and 0.61 ounce of silver per short ton, using a cut-off value of 0.2 ounce per short ton gold equivalent. Additional reserves were likely to be discovered.

Production during the commissioning period and the first year of commercial production was expected to be more than 400,000 ounces of gold and 2.6 million ounces of silver. Average annual production over the projected 10-year life of the mine, based on known reserves, was expected to be in excess of 210,000 ounces of gold and 2.1 million ounces of silver. The higher production at the beginning would be the result of treating higher grade ore initially while stockpiling lower grade material for processing later.

The Porgera gold-silver joint-venture project in the central highlands region of Enga Province on the main island continued progressing toward development, with mine construction expected to begin in mid-1988, contingent upon Government approval of the draft feasibility study, expected to be completed early in 1988, and the issuance of an SML. The Porgera deposit was owned equally by Placer Pacific operating as the manager, Renison Goldfields Consolidated Ltd., and Mount Isa Mines Ltd. Reserves were 4.5 million tons of ore grading 0.64 ounce of gold and 0.67 ounce of silver per short ton in the high-grade ore body, and 78 million tons grading 0.11 ounce of gold and 0.33 ounce of silver per short ton in the remainder of the deposit. It was considered one of the largest undeveloped gold deposits in the world, with an indicated gold content

of 12 million ounces. Construction of the mine site was expected to take 3 years from the granting of the SML. Two simultaneous mining operations were planned: an underground mine in the high-grade zone and an open pit. Production would be 800,000 ounces of gold per year for the first 5 years of mining, cutting back to an average of 640,000 ounces per year for the next 5 years.

Niugini Mining Ltd. began regular shipments near yearend of gold bullion from its small Mount Victor Mine near Kainantu, Chimbu Province, in the eastern highlands of the main island for refining in Australia. The 150,000-ton-per-year modular, transportable, carbon-in-pulp concentrator began operating in October. Annual gold production would be 15,000 ounces per year from a resource estimated at 314,000 tons grading 0.13 ounce of gold per short ton. Expected mine life was 4 years, but would increase if exploration drilling in the surrounding area identified additional reserves.

To the east of the Mount Victor Mine, in Morobe Province, Renison Goldfields completed the expansion of the mill from 400,000 to 476,000 tons of ore throughput at its Kerimenge gold mine near the old alluvial districts of Wau and Bulolo. Further modifications were being planned. Gold production increased from 5,658 to 20,737 ounces for the year ending June 30.

CRA conducted exploration drilling and engineering studies on its Hidden Valley gold prospect in the Morobe goldfield north of Wau. The deposit reportedly may contain 30 million to 50 million tons of ore grading 0.06 ounce of gold per short ton.

The Lihir Island Prospect on New Ireland Island in the Bismarck Archipelago, a joint venture by Kennecott Explorations (Australia) Ltd., 88% (acting as manager), and Niugini Mining, 12%, continued to be evaluated. Exploration drilling continued at the Minifie ore body, discovered in the fourth quarter of 1986. Preliminary estimated reserves were 22.5 million tons of sulfide ore grading 0.14 ounce of gold per short ton. All drill holes during the year were reported to have intersected ore-grade mineralization, and thus the boundaries of the ore body had not been determined. Reserves in the original Lihir discovery, the Lienetz ore body, were estimated by delineation drilling in 1986 to be 88.9 million tons of sulfide ore grading 0.8 ounce of gold per short ton and 8.1 million tons of oxide ore grading 0.6 ounce of gold per short ton.

Although no commercial petroleum or natural gas has been produced in Papua New Guinea, the country represents one of the largest unexplored potential oil provinces in the world. Despite repeated exploration failures since 1956, the area has the geologic potential for substantial deposits of oil. Exploration efforts remained concentrated around the Papuan Basin, consisting of the southern one-third of Papua New Guinea's main island and extending into the Gulf of Papua. These probes were stimulated by the discovery of the potentially large Iagifu Field by Chevron Oil Co. in 1986.

Table 5.—Papua New Guinea: Exports of copper in concentrates, by destination

(Metric tons of copper content)

Destination	1986	1987
China	9,207	9,296
Germany, Federal Republic of	62,513	54,270
Japan	77,373	61,675
Korea, Republic of	18,367	48,721
Spain	11,314	15,095
Unspecified	--	6,226
Total	178,774	195,283

Source: World Metal Statistics, July 1988.

SOLOMON ISLANDS

Mineral production in the Solomon Islands was limited to small quantities of clays, crushed stone, and sand and gravel used in domestic construction and minor amounts of alluvial gold.

Zanex Mavu, a joint venture by the Australian firm Zanex Ltd. (70%) and locally owned Mavu Gold Development Ltd. (30%), resumed operations at midyear. Its alluvial gold mine was in the Chovohio River at Mavu on the island of Guadalcanal, 30 kilometers southeast of the capital city of Honiara. The mine, the Solomon Islands only large-scale gold mine, was closed in 1986 when its recovery plant was destroyed by a cyclone. A secondhand plant was installed with a capacity of 17,000 ounces of gold per year. Installation of two additional recovery plants was under consideration at yearend, depending upon the results of bulk sampling to establish additional reserves, which would increase production to 50,000 ounces of gold per year.

Cyprus Minerals Australia Co., a subsidiary of Amoco Minerals Australia Co., continued its assessment of the large low-grade epithermal gold deposit in the Central Highland Range on Guadalcanal. Early in the year, Arimco NL agreed to spend $3.5 million[5] over a 3-year period for exploration and development in exchange for a 50% interest in the Gold Ridge prospect. In midyear, the Solomon Islands Foreign Investment Board approved the establishment of the new joint venture, Arimco (Solomon Islands) Ltd.

The Solomon Islands Parliament passed legislation governing the conditions for exploration and development of petroleum deposits. However, there have not been any reported hydrocarbon discoveries in the Solomon Islands.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Fijian dollars (F$) to U.S. dollars at the rate of F$0.8925=US$1.00.

[3]Where necessary, values have been converted from Australian dollars (A$) to U.S. dollars at the rate of A$0.64=US$1.00.

Mining Journal (London). V. 308, No. 7909. Mar. 20, 1987, p. 214.

[4]Where necessary, values have been converted from the Papua New Guinean kina (K) to U.S. dollars at the rate of K0.93=US$1.00.

[5]Where necessary, values have been converted from the Solomon Islander dollar (S$) to U.S. dollars at the rate of S$2.06=US$1.00.